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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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VOL. CXXXVII., No. 2806.] TUESDAY, FEBRUARY 20, 1917. [69TH YEAR.

EDITORIAL NOTES.

Coal Difficulties and Coal Control.

In many quarters distant from the sources of supply, coal difficulties are again, but with doubled vigour, harassing gas engineers; and these difficulties are not due to any shortage of output at the pits, but may be summed up by the one word "transport." The troubles are being experienced most acutely by those gas undertakings that have hitherto depended upon seaborne coal. This is due partly to submarine and mine dangers, but in greater measure to the delays that are occasioned by the restriction that limits to daylight the travelling of the coal-carrying boats, with the consequence that their delivering capacity over a period is greatly curtailed, and with this has to be associated a shortage of tonnage. The reduction of carrying capacity, through the limitation of running to daylight hours, is at its maximum point precisely during those days and months when the consumption of coal by gas supply undertakings is at its maximum. This means that, however optimistic we may be as to the future of the war, responsibility to maintain the gas supply claims every effort being made as the days lengthen to increase coal stocks as an assurance against whatever may befall, and even on a more liberal scale than was done last summer. It will not do to speculate on the chance of better conditions.

During the past week, this matter of the difficulties of transport, especially by sea, has again received prominent reference by Mr. Charles Carpenter, D.Sc., at the meeting of the South Metropolitan Gas Company, and by Mr. W. G. Bradshaw, at the meeting of the Commercial Gas Company. The seriousness of the position is not underestimated by them; and it is well illustrated by the percentage increased costs quoted by Mr. Bradshaw, and by his statement as to how additional vessels have had to be purchased by the East-end Company in order to fill the gaps in deliveries created by the longer duration voyages under present running restrictions. Early in the war period, there was strong advocacy of the acquisition of boats on a co-operative basis for the supply of gas undertakings with littoral or proximate littoral situation; and notwithstanding the developments of the methods of sea warfare, and the intensified difficulties and dangers of sea transport, we feel confident that, given suitable landing-places for the cargoes, there would, in view of the freight rates and the other conditions now existing, have been wisdom in the adoption then of the proposal. To-day ships are not allowed to be purchased without permission from the controlling quarter.

However, the position of rail-fed gas undertakings is to-day superior to that of those supplied by seaborne coal—at any rate, along the east and south coasts, though these concerns are all suffering more or less in relation to their distance from the coalfields from erratic deliveries of the rail-borne coal, supplemented by, in the case of certain gas-works along the south coast, unwieldy expenses compared with their pre-war payments for sea carriage. But coal must be had at any price for gas-making (it would never do to fail the consumers of gas in the present critical times); and fortunate are those formerly seaborne coal-supplied companies with good railway connections that have been able to secure substantial deliveries, and to accumulate excellent stocks. Their good fortune is intensified when able, as has been the case with one semi-Metropolitan gas company to act the good Samaritan to a seaborne coal-fed neighbouring concern by, from ample stocks, loaning an urgently required supply of coal to it. There can be no question the experiences of the present are going to make of us a more disciplined and look-ahead people. While wars of the present far-reaching character are not, fortunately, likely to be of frequent occurrence, a rule in every self-respecting organization will be in future to be prepared for any emergency; and it will, in view of the new sea warfare, be a matter of strategic importance that gas-works with sea carriage should choose sites blessed also with railway communication. But the immediate future is just now the more important thing; and those gas undertakings that are supplied by rail will have learned with satisfaction that the Railway Executive Committee have in contemplation some more changes in railway traffic with the view of increasing "essential traffic," including the distribution of food and other national necessities. Similar control to that exercised over the railways is also, it is reported, going to be applied to the canals and waterways. But there will be some doubt as to anything very beneficial accruing from this during the war, unless it be some co-ordination in working; for the canals and waterways of this country have had their usefulness sadly crippled by sheer and continuous neglect. However, one of the matters which the war must hereafter induce the Government to look into is this question of improved transport; for it must by now have been borne in upon them that, apart from the military aspect, transport is an important factor in the economic power and prosperity of the country.

Among the suggestive features of his address to the proprietors of the South Metropolitan Company, Mr. Carpenter introduced the idea that the coal supply of the Metropolis should be put under a coal controller, who should place fuel generally upon a war emergency basis, and who should be independent of the importunities not only of users but of merchants and distributors of coal. The idea was propounded on Wednesday afternoon; and on Thursday morning some of those gas proprietors who heard Mr. Carpenter may, on opening their newspapers, have allowed the words "intelligent anticipation" to slip through their minds. They saw that the Government had decided to take possession of the coal mines, and to appoint Mr. Guy Calthrop, the General Manager of the London and North-Western Railway, as Controller, with Sir Richard Redmayne, K.C.B. (His Majesty's Chief Inspector of Mines), to assist him. The Department is also to receive the aid of an Advisory Committee, "consisting of representatives of the Admiralty, the "Home Office, and Board of Trade, as well as the coal-"owners and coal miners." We may be excused for thinking that, with the failure of the Coal and Coke Supplies Committees, which were dominated by the coal interests, and seeing that among the many duties of the new department—in addition to controlling the mines, looking after finance and wages, and paying the colliery proprietors their pre-war dividends—is the installing of machinery for economical coal handling and distribution—that is to say, transport generally—the Advisory Committee should include representative large users of coal.

Mr. Carpenter's proposal goes deeper than that apparently contemplated by the Government scheme, as he holds that not only are the lines of work that are planned out for the new Government Department essential, but that these are times when every ounce of our principal raw material should be brought under proper utilization, and its use should be subject to licence. While he does not suggest that the use of raw coal for heating could be entirely dispensed with, he is of opinion that it could be largely for domestic purposes. He would have the coal treated at gas-

works, and the bye-products extracted that are urgently required, with the coke returned to the present distributors of coal. "We are dealing to-day with necessities not conveniences." True. But are the gas undertakings really prepared in present or any other circumstances—especially present—to undertake this additional work? Mr. Carpenter says they have the plant ready to hand, and this should be utilized to the fullest capacity, instead of allowing it to lie idle as so much of it is during the lighter months of the year. But we cannot reconcile the present conditions of the gas-works with the seasonal conditions of gas and household fuel requirements. During the lighter months of the year less gas is consumed, so that the spare plant could not well be used then for carbonizing coal in excess of gas needs. In the winter months, when the requirement for gas enlarges, are there the spare plant and a sufficiency of men in these times of war to deal with any large addition to the quantity of coal at present carbonized? It is this war period that Mr. Carpenter has in mind; and we cannot, considering the conditions all round, see the practicability of such prompt effect being given to his plan as to be of assistance now. We wish we could. We wish, too, that gas undertakings had long since taken steps to create for themselves a stronger position in the local solid fuel market. But our doubts might possibly be set at rest, if Mr. Carpenter would enlarge upon his generally stated proposal, by giving more detail which would throw light upon the matters that cloak practicability in some obscurity.

Benzol Extraction and Estimation.

THE contribution on this subject which Dr. Lessing recently made to the Society of Chemical Industry, and which was noticed in our issue for Jan. 23, both editorially and among the technical intelligence, is now available for publication *in extenso*; and it appears in another part of the present issue. It is felt that the paper should have this complete publication, in view of the fact that, by the proposed system of benzol extraction or, on a laboratory scale, estimation, Dr. Lessing has struck out a new line of operation, but the future of which (although promising on the laboratory scale) cannot be foreseen. Anyway, for it he deserves the fullest credit. It will be remembered that in the scrubber he used a porous material soaked in oil, which strips the passing gas of its benzol without the employment of continuously flowing washing oil. The preparation of the material is, of course, not a matter of difficulty for laboratory working; but the transfer of the process from the experimental to the working scale may produce unpremeditated experiences. The absorbed compounds are liberated *in situ* by steam distillation. No attention at all is required save for the periodical change-over from gas to steam, and to the collection of the distillate.

In view of our previous editorial reference, there are on this occasion only two or three additional points to which we desire to make allusion. The first is suggested by Mr. T. F. E. Rhead's paper on "Some Physico-Chemical Considerations on Benzol Recovery from Coal Gas," read before the Midland Junior Gas Association last month [see "JOURNAL" for Jan. 30, p. 207]. On referring back to the patent specification of Dr. Lessing's invention (from which specification extracts were published by us on Aug. 8, 1916, p. 258), it is shown that, even before 1915, he must—seeing that the patent is dated July 9 that year—have recognized that the efficiency of benzol extraction from gas, and indeed of debenzolizing, depends upon the ordinary laws of physical chemistry, and particularly on the neutral solubility of oil and benzol, and the vapour pressures of the resulting solutions. In practically every paper read on the subject of benzol removal from gas, there has been an expressed desire for an improved method; but no method will ultimately succeed that does not incorporate these physico-chemical considerations. It was doubtless the desire here alluded to that induced the publication of the paper at the present juncture. Another thing that has been urged as essential in promoting the efficiency of benzol extraction has been the provision of an improved and dependable work-economizing apparatus, by which the efficiency of the extracting process could be determined. And this plant on the laboratory scale clearly deserves attention as a means of control by tests which could be made both before and after scrubbing with the working plant, or the efficiency of the latter could be checked by the difference between its results and those realized by the experimental apparatus. With it, already some unsatisfactory efficiencies have been discovered on plants which have been held-up as shining examples of what should be done; and the revelation has been a matter of some surprise to those concerned. In this connection, the final remarks in our editorial article on Jan. 23 may be revived. It was then suggested that it would be useful to hear views as to whether, for portable and varied uses, a scrubber packed with non-porous material, from which at the conclusion of the test the oil is run and flushed-out for subsequent treatment in separate apparatus in the laboratory, has not distinct advantages, which may altogether outweigh the disadvantages Dr. Lessing seeks to avoid. We have not had any response to the invitation; but now that the text of the paper is available, perhaps there may be expressions of opinion from some of our laboratory friends, who, however, admittedly suffer in any comment or criticism they may make from the fact that up to the present (to the best of our knowledge) the only person who has had continued experience of Dr. Lessing's apparatus is the inventor himself. But it will be seen from the paper that he considers his self-contained apparatus more portable than the usual train of glass bottles, which are subject to breakage, leakage, and constant trouble with the rubber connections. Apparently, too, the flushing-out of the oil from a small test scrubber is in his view a very uncertain business, and necessitates a larger still in the subsequent distillation.

There is one other part of the paper that—in view of the signs that local authorities are getting on the track of the idea of seeking the limitation of the inert ingredients of town gas—is also of current interest, especially considered in combination with the work of extracting condensible hydrocarbons from the gas. There are times when we have said, "Save us from our chemical friends." But there are certain sinners in the gas industry who, making due allowance for an increased percentage of incombustibles in consequence of the extraction of crude benzol from gas, are sending out an undue proportion. They require saving from themselves; and we do commend to their attention what Dr. Lessing has to say. But as to complete debenzolization, the gas industry does not want (if it be possible to avoid it) to return to the process of special enrichment even by cheap crude materials, unless there be certain profit in it. Better by far will it be for work to proceed on the lines traced by the author in the paper, when he says that there are indications as to the possibility in the not-distant future of obtaining high makes of gas from coal without the necessity of dilution with nitrogen or carbon dioxide. If this comes to pass, "it will be possible to extract all condensible compounds from the gas, and still supply a commodity which in calorific value is far superior to that of the present day." This sounds promising. We are still waiting expectantly for further news as to working experiences from across the Atlantic.

Nitre-Cake for Sulphate Manufacture.

THE war has naturally caused an enormous increase in the output of nitre cake, which is the waste or residual product of nitric acid plants and the potting ovens of sulphuric acid plants. At the same time, it has greatly increased the demand for sulphuric acid; and since nitre-cake is substantially sodium bisulphate, or acid sulphate of soda, containing in practice acid equivalent to 28 to 36 p.ct. of real sulphuric acid, it is obvious that it would be considered as a possible source of acid in chemical manufactures. Where it is not essential to use pure or concentrated sulphuric acid, and the presence of the neutral sodium sulphate of the nitre-cake can be tolerated in the product, or where it can be eliminated from it, the utilization of nitre-cake in partial substitution of commercial sulphuric acid has been attempted, and has made some progress.

In normal times a profitable application of the bulk of the nitre cake produced seems, however, still to be sought. Having regard to the high price and scarcity for ordinary uses of sulphuric acid at the present time, there is, however, temporary scope for the use of nitre cake in some branches of chemical industry. Thus a proposal made by H. J. Kirkman in 1889 to use it as an absorbent for ammonia appears to have received little attention until early last year, when the Ministry of Munitions issued a circular suggesting the use in sulphate plants, in lieu of sulphuric acid, of a mixture of two parts of a saturated solution of nitre-cake with three parts of chamber acid [*vide* "JOURNAL" for March 7, 1916, p. 523]. The general adoption of this suggestion would, it was estimated, admit of the replacement by nitre-cake of 15 to 25 p.ct. of the sulphuric acid used in the manufacture

of sulphate of ammonia. The resultant sulphate, however, would contain only 18 to 20 p.ct. of ammonia, instead of the normal 25 p.ct. It was clear that such salt would not command a ready market even at home, and that exporters would be unable to place it in competition with good sulphate from the American continent and with nitrate of soda. Moreover, it was not clear that nitre-cake would not greatly enhance the wear and tear of sulphate plant, and that the greater acidity of the product would not be more destructive of bags. Sulphate makers, with every desire to liberate as much sulphuric acid as possible for use in explosives works, were not anxious to add to their difficulties of working by adopting the suggestion; and probably few of them have employed nitre-cake on any considerable scale.

Sulphate makers will be very grateful to Mr. P. Parrish, the Manager of the East Greenwich Chemical Works of the South Metropolitan Gas Company, for the exhaustive investigation of the question of the partial use of nitre-cake in sulphate manufacture which he has undertaken, and of which he gives a clear account in another part of to-day's "JOURNAL." While demonstrating that sulphate of soda may have an indirect value as a manure by liberating potash from its combinations in clay soils, he rightly considers that the maximum permissible proportion of sulphate of soda in the salt produced must be kept as low as 10 p.ct. if the salt is to be generally marketable. He goes on to show that a mixed salt containing 10 p.ct. of sulphate of soda cannot be produced on the large scale if the nitre cake is applied in the form of an aqueous solution, which would give a theoretical maximum of 3·65 p.ct. of the soda salt in the mixed sulphate. If, however, the nitre cake is dissolved in the feed acid to the saturator, and 14·7 tons of nitre cake are taken to every 82·7 tons of 80 p.ct. or every 94·5 tons of 70 p.ct. sulphuric acid, a mixed salt containing 10 p.ct. of sulphate of soda and 90 p.ct. of sulphate of ammonia can be produced. This procedure admits of a considerably larger proportion of nitre cake being utilized than that suggested as the maximum some time ago by the Sulphate of Ammonia Association—viz., 1 ton to 10 tons of 70 p.ct. sulphuric acid. Whether it would be prudent from commercial considerations to exceed the latter proportion in practice is a question which gas-works' and coke-oven administrations must determine according to the prospects they have of securing acceptance by their customers of a mixed salt richer in sulphate of soda.

From the technical standpoint, Mr. Parrish has demonstrated that there is no insuperable working difficulty in using nitre cake to produce a mixed salt containing 10 p.ct. of sulphate of soda; and managers of sulphate plant will be very glad of the valuable hints and suggestions he offers. If it is in any way feasible to substitute such a salt on the large scale for ordinary sulphate of ammonia, without "queering" the sulphate market, every effort will be made by managements to do so, in order to liberate a considerable quantity of sulphuric acid for the use of explosives works. Thus Mr. Parrish's contribution deals opportunely with a question of true national economic importance.

The Problem of the High-Pressure Meter.

ONE of the problems of latter years has been the production of a self-correcting high-pressure gas-meter, applicable to all the changing conditions to be encountered. Those who have, with more or less success, attacked this problem have our sympathies; for the difficulties produced by varying pressures and temperatures, and translating to a common basis at the meter-index the volumes of gas passed, are strongly opposed to any simple mechanical solution of the problem. Mr. R. G. Marsh has found this. He has been working at a high-pressure meter since 1912; and his first patent specification was published in 1913. From then until recently, he has met with a series of difficulties, in the solution of which Mr. C. M. Walter, B.Sc., has collaborated during latter years. There is considerable ingenuity spread over the whole of their work; and we are rather sorry that the simplicity of the principle on which the first meter was constructed, and which principle was originated by Mr. Marsh, has the disadvantage of making the meter unduly bulky. Where, however, size is not an objection, we take it this form of meter will still be available.

In the original meter, the gas pressure itself is made the operating medium in automatically altering the capacity of the measuring drum, so that at the lowest pressure of the gas at which the meter is required to work, the drum is at its maximum capacity, and at the highest pressure of gas it is at its minimum capacity. The meter is a wet one; and the alteration in drum capacity is effected by its rise or fall above or below the water-line. By this means for a given number of revolutions of the drum, the movement of the index-wheels is constant; but for a given volume of gas at low pressure, the number of revolutions of the drum is less than when passing an equal volume of gas at high pressure. As would be anticipated with the up-and-down movement of the drum governed by the gas pressure, one of the main difficulties was that of friction, which we should imagine would be accentuated by the resistance of the water coming into action—perhaps not to a great extent, but still a factor and increasing with the advancing depth of the drum in the water, and with the gradual changing of the density of the latter. It was found that there was a sluggish action in the movement of the drum in the carrier cradle with small variations of pressure; and it was in this particular connection that Mr. Walter produced an improvement by which frictional disadvantage was diminished. Even then, till some positive proof to the contrary, it would be difficult to avoid some little suspicion as to the drum responding with desirable promptitude to fluctuations produced by sudden considerable increases or reductions of gas demand, such as one meets with in industrial operations. Care would also have to be taken to keep the water-line constant. The results obtained under test conditions in a laboratory show good accuracy; but these can hardly be accepted without question as being the results that would be obtained under ordinary working conditions. All the same, the principle of the meter is very attractive; and improvements may still be possible which will eliminate the main disadvantage that the inventors see—that is, the one of dimensions.

However, a second type of meter has been designed in which a **U** tube is employed, having one limb closed, and the other open. The tube contains mercury, upon which operates the pressure of the gas to be measured. By the aid of a float on the mercury surface, with an operating rod attached to it, gear changes are effected in the index mechanism, which give the necessary correction to the registering train. In this type of correcting meter, the new arrangement has been applied to an existing form of mechanism patented by Messrs. Parkinson and W. & B. Cowan. It is generally considered by those who have had an opportunity of investigating these meters that the second type—we take it on the grounds that it will be more sensitive to slight variations of pressure, and is not of inordinate size—is the preferable one. However this may be, the principle of affecting corrections through the automatic variation of drum capacity should not be relinquished as incapable of further development.

Present Gas Prices Found Wanting.

The increasing difficulties of the times are being mirrored by fresh movements towards higher prices for gas. The Gas Light and Coke Company are going to raise their charges. By how much is not yet known. The Brentford Company are going to do the same—by 4d.; making the war addition the modest one of 6d. The Commercial Gas Company cannot see their way to go on without making an advance—to what amount and when to be inflicted are points to be determined. The South Metropolitan Company last summer reduced their war increase by 2d.; bu already, so rapid are the changes in circumstances, the Chairman (Mr. Charles Carpenter, D.Sc.) cannot speak with certainty as to the maintenance of the lower charge. He says: "Whether we shall be able to get through the year without raising the price of gas it is impossible to say. It all depends upon the freedom with which we can carry coal to our works from the North; and as to this no man can prophesy." The Tottenham Light, Heat, and Power Company also find an increase imperative, in circumstances related by the Right Hon. Sir Daniel F. Goddard at the meeting of the proprietors last Saturday, as reported to-day in our "Miscellaneous News" columns.

Big Increases in Consumption.

With the development of their heating business, gas companies have to be prepared for large fluctuations in the demand for gas; but such fluctuations, at the best of times, are not so economical as a fairly regular rate of upward progression. But gas undertakings as traders subject to competition in every quarter cannot

pick and choose; they must regard themselves as victims of circumstances, and think themselves lucky they are so strongly fortified by the diversity of the demand made upon them for their staple product. In January, the Gas Light and Coke Company had a 19 p.ct. increase in output compared with January, 1916; and the Brentford Gas Company up to the mid-week, Feb. 7, had had an increase of 106 million cubic feet, compared with the same period of last year. This remarkable short-period increase was only between 11 and 12 millions short of the total increase for last year! The Chairman wondered whether there are any other gas undertakings of equal size that can match this record—a record due to the severity of the weather. There is embarrassment in such riches, particularly with the state of war making manufacturing materials hard to get, and with a shortage of labour to deal with the extra carbonization. Besides, new consumers and orders for gas-consuming apparatus keep rolling in without break and without asking for them. But capital is refused in view of the requirements of money for prosecuting the war, gas appliances are dearer than before, and the number of available skilled men is not equal to the amount of fitting work. There have lately been a few regrettable experiences with old-fashioned and wrongly used gas-heating appliances; but, fortunately, there are not many people who are so ignorant that they do not know that gas appliances rightly fitted and used are as safe as any other convenience in the world. If the products of combustion of a gas-fire were as visible as smoke from a coal fire, misusers of the former would take care not to do such a silly thing as to close-up the chimney outlet. Coal fires treated in the same way would produce much the same consequences. However, the popularity of the gas-fire has vigorous growth, which demonstrates much which is as satisfactory to the gas industry as it is objectionable to competitors who are struggling to maintain the crude system of heating by coal, or trying to make shivering people believe there is economy in room warming by electricity. Perhaps there would be a better chance for electricity if houses were built on health-impairing lines, by stopping-up all air inlets and outlets in rooms and insulating the walls and ceilings.

Company Business.

In only one year since 1892 have the receipts of the Board of Trade on account of companies winding-up proceedings been greater than was the case for the twelve months ended March 31, 1916. This fact appears in the twenty-fifth annual report on matters within the Companies Acts, 1908 and 1913, which deals in most respects with the figures for the twelve months ended Dec. 31, 1915. There were, it seems, in that period 3749 new companies registered in England and Wales, while 4634 were removed from the register; the net result being a decrease for the year of 885. The war and the consequent Treasury restrictions have, of course, paralyzed company business for the time being; and the 1916 figures will probably make a worse showing than those now under discussion. The total amount of nominal capital of the 3749 companies registered in England and Wales during 1915 was £49,284,267, as compared with 5701 companies having a capital of £104,306,797 in 1914—the average nominal capital of each company falling from £18,296 to £13,146. The total number of companies registered in the United Kingdom decreased from 6214 in 1914 to 4062 in 1915, the total nominal capital from £113,251,583 to £53,354,606, and the average amount of nominal capital from £18,225 to £13,135. However, in spite of the falling off just noted, there were at the end of 1915 about 59,000 companies on the register in England and Wales, and 66,000 for the United Kingdom. In certain cases, a familiar kind of trouble was incurred, in the enforcement of returns to the Registrar of Joint-Stock Companies. Proceedings were, in reference to six companies, taken to enforce these returns, to secure the filing of documents required by Statute to be filed for public information, and to recover penalties for failure to comply with other provisions; and in addition to these legal proceedings, there were a number of summonses issued against liquidators in voluntary liquidations to enforce the filing of accounts, and against receivers for debenture holders to enforce the filing of abstracts of their receipts and payments. The Solicitor is, however, careful to point out, in regard to proceedings for penalties, that where it has been ascertained that delay or default in performing statutory duties has been really owing to dislocation of business caused by the war, every consideration has been shown to those in default. Only in cases where it has been felt to be absolutely necessary to enforce compliance with the Statute have proceedings been taken.

The Workman's Financial Part.

The War Loan is reported to have been a great success; and no doubt gas undertakings and gas directors, committeemen, and officials, as well as manufacturing firms identified with the industry, have done their share in making it so. But duty in the matter does not end there. It is an obligation upon those who are in a position of influence with others to exercise it in the cause of war finance. The workers of the country appreciate being looked upon as factors of importance in the national life and system; and, generally speaking, they are willing to follow where friendly officials lead. With their men gas engineers, as a rule, have great influence; and, in this matter of helping to accumulate the little sums in the finance of the country, they should take the initial steps. Various instances have come under notice where this has been done; and everywhere the old experience is receiving fresh confirmation, that the working man is influenced more by personal contact than by literature and speeches—the one probably many of the men do not take the trouble to read, and speeches also with many have no abiding effect. This, of course, does not apply universally. For the purpose in view, one of the best methods of approach is to first get the sympathy of some of the men, and form a committee, the members of which will have a good effect in leavening the rest not so much with the spirit of patriotism (that is already there), but with the feeling that patriotism in these times also claims substance according to means. Numbers of workmen would be prepared to do something financially for the country if facilities were brought within their reach where they work. There are several schemes whereby this can be done; and upon how to set to work to interest men and start and make war savings schemes a success, a large amount of light is thrown by Mr. S. E. Halliwell in a comprehensive article which he has contributed on the subject to our columns this week, and for which we thank him. Example stimulates; and so, in order to spread interest, we shall be pleased to have news from officials as to what is being done on their works.

Percentage of Ash in Gas Coal, and its Effect.

During the last few months, there has been found, practically throughout the industry, a considerable increase in the percentage of ash in the coal supplied. The bad effect that this has on the yield of gas per ton, and the increase in the percentage of ash in coke, is very serious. For example, before the war, it was quite possible to obtain 12,000 c.ft. per ton from a coal containing (say) on an average 4 p.ct. of ash. Now it is not a rare thing to find the percentage of ash up to 10 p.ct. or even 15 p.ct., which, of course, means that there is being carbonized an extra 6 to 11 p.ct. of rubbish, or, in other words, 6 to 11 tons in every 100 tons of coal delivered, compared with that supplied prior to the war. The effect of this additional percentage of ash on the yield per ton can be seen at a glance, and can be accurately ascertained by simple proportion. If a coal contains 4 p.ct. of ash, or, in other words, 96 tons of "pure" coal out of 100 tons gave 12,000 c.ft. per ton, then a coal containing 10 p.ct. of ash, or 90 tons of "pure" coal, would yield 11,250 c.ft. per ton, or to put it mathematically: $96 : 12 :: 90 : x$. As shown here, an extra 6 p.ct. of ash causes the very serious drop of 750 c.ft. per ton. The effect on the coke is to increase its ash content in proportion. This, of course, is of material importance where coke is used for boiler fuel, and especially for those who are under contract to keep the percentage of ash and moisture below a certain limit. In view of these conditions, great care should be taken when sampling coal. The larger the quantity taken the better. This should be quartered in the regulation way, and not less than 7 lbs. should be ground in a mill, and well mixed before the final sample is taken.

Coal and Coke Exports.

The interest that has so far during the war been supplied by the details of the Board of Trade returns relating to coal and coke exports is to be denied—we take it—during the remainder of the war. The reason for this is not clear, unless it be either to keep from the enemy or neutral countries the destinations and quantities of the exports, or to further economize in the Department's work. The January issue of the returns only incorporates the aggregate shipments of coal, coke, and manufactured fuel during

the month, in comparison with the corresponding period of 1915 and 1916. From these totals it is seen that there has been a reduction in the exports contrasted with January, 1915, but an increase of about 100,000 tons compared with the same month of 1916. But there has been considerable augmentation of values. The total exports were: January, 1915, 3,769,598 tons; 1916, 3,383,099 tons; 1917, 3,488,494 tons. The values were: January, 1915, £2,580,262; 1916, £3,222,250; 1917, £4.588,227.

PERSONAL.

At the last meeting of the Belfast Corporation Gas Committee a resolution was passed placing on record the Committee's appreciation of the valuable services rendered by Alderman JAMES CRAIG, J.P., during his six years' tenure as Chairman. Mr. J. A. LAUGHLIN is the new Chairman of the Gas Committee, with Mr. D. JONES as Vice-Chairman.

The Directors of the Tunbridge Wells Gas Company, in their annual report to the proprietors, intimate with much regret that [as has already been stated in the pages of the "JOURNAL"] Mr. ANDREW DOUGALL has, in consequence of ill-health, resigned his appointment of Engineer and General Manager as from the 31st prox.; and they desire to place on record their high appreciation of the great services he has rendered to the Company during the long period of thirty-six years.

Readers will have been gratified to note in the Honours Lists announced last week more than one name that is well known in the gas industry. In recognition of services during the war, Mr. ARTHUR M'DOUGALL DUCKHAM (of the Woodall-Duckham Vertical Retort Company), who is Chairman of the Advisory Committee, Ministry of Munitions, has been created a Knight Commander of the Order of the Bath. Mr. STEPHENSON KENT, Director of the Department of Labour Supply, Ministry of Munitions, who has been similarly honoured, is connected with Messrs. Stephenson Clarke and Co., the coal factors. Mr. JOHN GRICE, the Chairman of the Melbourne Metropolitan Gas Company, has had conferred upon him the honour of Knight Bachelor; and Mr. GEORGE A. TOUCHE, M.P., a Director of the Continental Union Gas Company, has also received a Knighthood.

OBITUARY.

At the close of the meeting of the Scottish Junior Gas Association (Western District) on Saturday, the President (Mr. G. T. Purves) announced with regret the death of one of the honorary members—Mr. J. NAPIER MYERS, of Saltcoats.

The death is announced as having taken place on the 6th inst., in his 80th year, of Mr. WALTER MORGAN, formerly for over twenty years an Inspector to the Gas Light and Coke Company. He has been buried in Highgate Old Cemetery.

Mr. J. LANGDON THOMAS, whose death is just reported, was reputed to be one of the wealthiest men in Exeter. He never took a prominent part in the public life of the city, but did useful service in a variety of ways. At one time he was a Director of the Exeter Gaslight Company.

THE GAS INDUSTRY AND THE WAR LOAN.

AT the moment of writing, nothing definite is known as to the total figure which has been reached by the subscriptions to the War Loan; but expert opinion is the same everywhere—that a huge success has been achieved. Sums are spoken of and written about which are so vast that the mind is hardly equal to grasping their real significance. Once more the people have responded fully to the call made upon them. It is true they were merely requested to invest heavily, at a rate of interest which but a very short time ago would have been absurdly generous, in the finest security the financial world can offer. They were asked, however, to do it—and this is the spirit in which the response has been made—first and foremost as a duty to the country; and it is just this reflection that makes the acknowledged success of the loan so gratifying. The "Loan to Win the War" is what it has been called; but if unhappily the savings of the people should prove insufficient to wholly achieve this end, there will still be the credit of the Empire to draw upon. It is therefore comforting to think that, as a nation, we are not yet in sight of the end of our financial resources.

During the past few weeks all sorts and conditions of men—and women—have been sending in their applications in one of the several ways provided; but, while some of the larger subscriptions have been mentioned in the papers from day to day, the vast majority have necessarily not received publicity. It was this fact which led to the request being made in the last number of the "JOURNAL" that gas companies, gas authorities, and manufacturing firms should send along particulars of their contributions and their schemes, in order that as complete a list as possible might be placed on record. From the replies received, and from other sources—principally, it must be confessed, from "other sources"—the following names have been arranged in alphabetical order; and it is hoped that it may be possible to supplement them in future issues. The present instalment can be regarded as no more than indicative of what the industry as a whole has done.

In publishing this list of contributors, there are one or two points to which attention may briefly be drawn. In connection with the subscription of £250,000 by the South Metropolitan Gas Company, it was stated by Mr. Charles Carpenter at the meeting last week that this is in addition to giving the employees of all grades facilities for purchasing the stock. These schemes are, of course, a very important feature of the loan; and one is glad to see so many of them have been started. As Mr. John Mews, at the same meeting, remarked, it is the smaller people who will really provide the means to supply the country; and modest weekly savings soon reach a substantial sum. A case in point is Birmingham, where the scheme of the Gas Department for enabling employees to contribute has been a remarkable success. A sum of £38,500 had, by the middle of the week, been subscribed by 1330 of the staff and workpeople; and it was hoped £40,000 would be reached by the closing of the lists. This stock will be gradually paid for in small weekly instalments. Particulars of this scheme were given on p. 243 of the "JOURNAL" for the 6th inst.; and the provisions of a plan put into operation by Messrs. Glover and Main were reproduced last week [p. 310].

Mention should be made, too, of the offer of Messrs. Stewarts and Lloyds to advance up to a year's salary to members of their office staffs, to enable them to subscribe to the War Loan. This offer was taken advantage of in about 450 cases; the amount so subscribed totalling £32,000. Messrs. John Yates and Co., of Aston, have also introduced a scheme under which their employees may subscribe by instalments of not less than 1s. weekly for each £5 taken up; the firm finding the needful money free of interest.

As is the case in many other directions, invitation to subscribe to the loan has, of course, come at a time when the monetary position of gas undertakings is not generally an easy one. An example of this is provided by the Preston Gas Company. Here the Directors had under consideration the question of subscribing to the loan; but as the undertaking is already working on a considerable bank overdraft, it was found that no direct assistance could be given. They have, however, the Engineer and Manager (Mr. Samuel Tagg) states, purchased £2000 of War Savings Certificates, as a benefit to their employees, who may take them up at cost price before Dec. 31, 1918. Finally, as touching on the lighter side of the subject, there may be quoted a statement which has appeared in the newspaper Press—that the Harrow Urban District Council, having "saved £1000 through having no lights in the streets, have invested it in the War Loan." Should a subscription of this kind be claimed as a contribution by the gas industry?

The sums mentioned in the following list are in some instances all "new money," while in others they include conversions of previous holdings.

Belfast Gas Committee	£26,000
Birmingham Corporation Gas Department	38,500
Bishop's Stortford and Harlow Gas and Electricity Company	5,000
Brighton and Hove General Gas Company	10,000
British Mannesmann Tube Company	50,000
Brotherton, Colonel E. A.	500,000
Burton-on-Trent Gas and Electricity Committee	25,000
Cannock and Hednesford Gas Company	5,000
Chesterfield Gas and Water Board	20,000
Commercial Gas Company	31,150
Cromer Gas Company	2,000
Dalkeith Gas Company	1,000
Derby Gas Light and Coke Company	60,000
Droitwich Gas Department	750
East Cowes Gas Company	2,000
Edinburgh and Leith Gas Commissioners	43,500
Elland-cum-Greetland Gas Company	11,000
European Gas Company	40,000
Falk, Stadelmann, and Co., and Directors	54,000
Mrs. Soloman Falk	12,200
Miss Audrey Falk	1,426
Gandy Belt Manufacturing Company	35,450
Glenboig Union Fire Clay Company	50,000
Grantham Gas Company	5,000
Hebden Bridge and Mytholmroyd Gas Board	2,600
Institution of Gas Engineers	1,000
Keith, Mr. James (4th application)	40,000
Keith and Blackman Company	10,000
" " " Employees	5,000
National Gas-Engine Company	200,000
North Middlesex Gas Company	5,000
Plymouth and Stonehouse Gas Company	25,000
South Metropolitan Gas Company	250,000
Southgate and District Gas Company	5,000
Stanton Iron-Works Company	275,000
Stewarts and Lloyds	500,000
Uxbridge Gas Company	5,000
Wakefield Gas Company	6,000
Wandsworth, Wimbledon, and Epsom District Gas Company (in addition to conversion)	40,500
Welsbach Company	55,850
" " Mr. B. Cars (Managing Director)	25,050
" " Employees	1,500
Yeadon and Guiseley Gas Company	1,000

INSTITUTION OF GAS ENGINEERS.

The Annual Meeting Arrangements.

THE Secretary (Mr. Walter T. Dunn) has issued to the members a circular giving particulars of the arrangements so far made for the annual meeting in June.

As already briefly announced, this meeting will take place in London on Tuesday, the 5th of June, under the presidency of Mr. Arthur E. Broadberry, M.Inst.C.E., who will deliver an address, after which the annual report of the Council, and reports of Committees will be presented, but no papers will be submitted. On the following day, by invitation of the President, a visit to the works of the Tottenham District Light, Heat, and Power Company will take place, to view the entirely new section of the works for the production and purification of 4¾ million cubic feet per day, which is now approaching completion. Opportunity will also be given to inspect the Company's electricity generating station at Wood Green. The annual meeting of the contributors to the Benevolent Fund will be held on the Tuesday; and on behalf of the Committee of Management, Mr. Dunn calls attention to the good work which is being done by means of the fund. At the present time there are fifteen grants in operation. Recent deaths of subscribers have materially reduced the income; and the Committee, therefore, are anxious to obtain new supporters and increased subscriptions.

ELECTRICITY SUPPLY MEMORANDA.

As readers of the "Memoranda" are well aware, the installation rules of the Institution of Electrical Engineers have undergone from time to time a number of revisions by some of the most competent electrical engineers; and equally competent men have on each revision—including the last one—found faults in the finished work. This seems to suggest that no one electrical engineer is a complete master of all the details of his business. If there is such an engineer, obviously he has not had part in the revision. The regulations show the exquisite care that has to be taken at every point of an installation, with the view of making it as safe as possible. Yet with all the provision in the way of guidance, troubles of many kinds happen. There are also the Home Office and the Insurance Companies' electrical regulations, all of which point in the direction of necessity. On previous occasions, we have spoken of the voluminous character of the rules that have been framed in this country in the attempt to safeguard user, worker, and property against the insidious and mischievous work of electricity. But judged by the American standard of what is considered as necessary, we shall in future have to regard all this work as extremely modest. The Bureau of Standards have issued a National Electrical Safety Code—dealing with supply stations, installation and maintenance of electrical utilization equipment, and operation of equipment and lines—which runs into no less than 323 pages. All this is deemed necessary for the one purpose of safety. The more ferocious the brutes at the "Zoo," the greater the care taken in the construction of their dens and cages. The "Electrician" does not like to see this tremendous array of rules and regulations from America; it is all too suggestive of the opposite of safety. Therefore it thinks that, in attempting to cover so much ground, the rules may not secure the end for which they were issued. Nor does it like the detail into which the regulations go. While it agrees that the discussions which follow each section, setting forth the grounds on which each of the rules has been based, may serve a useful purpose, it says it is a question how far it is desirable to go. This can be well understood by anyone who knows anything of the relation of electrical pretence to actual fact. As opposed to our contemporary's criticisms and fears, is the acknowledgment that the code is "the considered opinion of a large number of experienced engineers in the United States." It is manifest that this large number of experienced engineers do not agree with our contemporary's views. The code is the outcome of a great deal of work; and this shows that the compilation has not been hurried over, and that all that has been done has been considered necessary. Thirty different conferences have been held in the United States in connection with the regulations; and at a conference in New York in the autumn of 1915, more than a hundred persons participated. However, whatever may be individual views as to the detail being in excess of requirement, our contemporary thinks that British electrical engineers would do well to have a copy of the code. The National Electrical Safety Code of America, *plus* the rules of the Institution of Electrical Engineers, *plus* those of the Home Office, *plus* those of the Fire Offices, *plus* the requirements of local authorities (such as the London County Council) in regard to amusement and other places of public assembly—the British electrical engineer will soon wish that he had chosen some other vocation.

Bulk Supply of Safety Rules.

Permanence of Electrical Postulation.

Postulation is a trouble from which the electricians suffer painfully; and there seems to be no cure for it. It shows itself in all manner of unexpected places. It was heard in the Patents Court recently, when Messrs. Benham and Sons, electric apparatus makers for culinary purposes, applied for a licence to use a German patent for an electric heating element for immersion in water and other liquids. The patent is No. 26,347 of 1912; one Martin Albrecht, of Frankfurt-on-Main, being the patentee. The element consists of the resistance suitably insulated, which is placed in a metal casing in such a way that the current is transmitted almost instantly to the wall of the casing. We do not know why Benham and Sons are so anxious to secure the use of this immersion heater, when there are others of British origin which doubtless they could employ by paying a royalty (as they have to do for the German production) of 5 per cent. to the end of the war. Whether there is anything in the statement that this particular type enables a heating capacity being produced equal to 10 to 50 watts per square centimetre of surface, is not known. But the assertion that the efficiency is believed to be 95 p.ct. does not attract us, as some of the claims put forward for the heating of water electrically have been found to be in excess of 100 p.ct. efficiency using British immersion heaters, without allowing anything for heat escape by radiation, convection, and conduction. The applicants want to use the elements for kettles, instead of outside elements; and they wish to utilize the system in the making of sterilizers, &c. But as to the postulation. It fell with beautiful glibness from the mouth of the Assistant Manager of the applicant firm (Mr. C. R. Allansby) into the ears of the Controller (Mr. Temple Franks). This is what Mr. Allansby is reported to have said: "Electricity in the kitchen was receiving consideration in these days, when economy of foodstuffs was the first consideration." There is a good deal of "consideration" there; very little more, and people will find that the cost of the war also demands attention, and that money is to be saved by using a cheaper heating agent than electricity. However, we proceed to read: "Meats cooked by fire or gas shrank a sixth in bulk. With electricity this was saved." This we should like Mr. Allansby to demonstrate, using equal temperatures, duration of cooking, and weight and structure of joint. "People with electric kitchens could warm by electricity instead of by coal or gas; and that, too, was a consideration." Of course, any stupid person "could" warm by electricity if he so chose; but we have not heard of a single sane man or woman who during the recent spell of cast-iron cold boasted of having selected electricity as a heating agent.

Heating and "Cooking" by a Reflector Fire.

The minimum of utility about which the maximum fuss is made is a very fair comment upon the description published by the "Electrical Times" of what is called a combined electric fire and cooker, designed by Mr. H. S. Ellis, the Borough Electrical Engineer of South Shields, and his assistant, Mr. J. C. Peterson. The old gas-fires, with their burnished copper reflectors at back and sides, using luminous flames, were in existence very many years before the first Electric Lighting Act was passed. Now these electrical "inventors" take a casing built-up in much the same way, but with another reflector at the top. They insert a wire element (which gets red hot) horizontally at the bottom; and under this a deflector-plate is placed. By the fixing of the heating element in this position, it is stated, "kettles, pans, and other cooking utensils" may be placed over it. It does not say how many of these utensils can be used at once in the little casing. Anyway the free use of the plural suggests that the utensils are of the doll's house variety. If only one utensil is used, we should imagine that it would have to be of a somewhat diminutive order, and that great care would have to be taken not to damage the heating element. It is also alleged that the device can be used for grilling purposes. Trouble may be anticipated unless the "grilling" be done in some enclosed arrangement; and then the question is whether the viand would be grilled or steamed in the self-generated vapour. But it is evidently open grilling that is contemplated, seeing that for this purpose an element open at both sides—top and bottom—would be employed, so that half the heat rays would be thrown downwards on the food. As a room-heater, we are told, "the bulk of the heat from the glowing elements is deflected upwards, and that which is thrown off in a downward direction is deflected upwards again by the reflector beneath the units, eventually being thrown outwards in a more or less horizontal direction by the reflecting surfaces at the top and sides." With all this acrobatic diverting of rays by the reflectors, it would be interesting to have the radiant efficiency of this marvellous article put under scientific test—say, at the Leeds University or the Imperial College of Science.

New Electric "Fires."

There have not been many new electric-fires placed on the market this winter season. Among the most noticeable are those known as the "Creda," made by Credenda Conduits, Ltd., of Aston, Birmingham. The casings of the fires are cast iron; and certain of them are quite ornate productions, "tips" for which seem to have been obtained from some of the modern gas-fires. The electric-fires are of the bar type, with nichrome wire coiled vertically on grooved fire-clay bases. The bars (of which one, two, three, or four can be placed in a fire according to the size of the frame, and the heating capacity required) are each made for 600 watts, or more. Details will be of interest for comparison with gas-fires. There is a plain fire which can be fitted with two or three of the bars. The frame (which looks remarkably like a gas-fire casing) measures 17 in. high by 11½ in. wide by 4¼ in. deep, and the weight is 18 lbs.

With plain cast-iron frame, the cheapest pattern is listed at 27s. 6d. A more picturesque design contains similar unit bars, but is rather broader on the face. The maximum loading is 3 KW. The fire measures 21½ in. high by 20 in. wide, and 11½ in. deep, and weighs 36 lbs. A plain pattern is listed at 80s. What the more ornate patterns cost the "Electrician" [from which these particulars are taken] does not mention. A pillar fire, with one or two unit bars, or other number, placed on a slight incline lengthways—instead of horizontally—so providing an excellent lodgment for dust, is made for halls and corridors. The cheapest plain pattern with single unit element is listed at 30s. There is no information as to whether the trouble with bar elements has been overcome through certain chemical action due to the unfriendly attitude one towards the other of the wires and the fireclay. We should like some durability tests made by a disinterested investigator of bar element fires under ordinary working conditions from extreme cold to the high temperature running of the wires, thus exposing the fireclay to constantly and widely varying temperatures. Also, as in the case of the arrangement mentioned in the preceding paragraph, tests giving the results of radiometer observations would be instructive.

Fatalities through Negligence and Joking.

There is doubt as to whether it is very much good fining factory owners for disobedience to the regulations issued by the Home Office to protect workers against electrocution or other physical, mental, or moral damage. The non-observance of the regulations appears to be almost as general as their observance; and something ought to be done of a more drastic nature to ensure that factory owners make a point of not being negligent where elecricity is concerned. Of course, the cases that are met with, almost week by week, of deaths through the use of electricity in industrial occupations, suggest that the regulations themselves are not without apertures in their protecting covering, though some of the fatalities are unquestionably due to breaches of the regulations, which is not a nice thing for employers to have on their consciences. The Buxton Lime Firms Company, Ltd., have lately been summoned for having failed in two instances to comply with the Factory and Workshops Act. A short time since, one of the Company's men—Thomas Bennett—was found lying dead near a tunnel on an iron pipe which contained an electric cable for lighting purposes; and it was stated in evidence that, had this pipe been properly earthed, death would not have occurred. The firm had to pay a fine of £10! There is another person who should have a lesson administered to him which would make him and his like refrain from playing dangerous "jokes," yclept by some "practical jokes." Not long ago a man named March was killed at a workman's cabin on the L. & N. W. R. at South Hampstead. Someone for fun connected the electric lighting wire with the handle of the door; and on March going to enter, he received a shock, and died almost at once. In electrical circles, the "safety" of electricity is sometimes mentioned, in, we suppose, just the same way as the Kaiser would speak of the peace-promoting mission of his mad submarines.

Ash Content of Coal.

It is strange to note how, since the war started, the coal supplied for steam-raising to electric supply stations has developed a larger ash content than before. This is difficult to understand, seeing how closely coal demand keeps pace with supply; and it can hardly be supposed that the colliery owners are utilizing the present conditions to work out seams of the poorest quality. However, the complaint seems to be pretty general; and the gas industry unites itself as fellow sufferers. The higher ash content has been given in many places as a partial reason for greater coal consumption, *plus* extra war costs, per unit generated. Take Stepney as an example. The report and accounts to March last have only recently been published; and a deficit is revealed of £5864—the first for many years—which shows that the increase made in the charges for electricity has not been sufficient. The Electrical Engineer estimates that the abnormal conditions during the year cost the undertaking an extra £24,700, of which he calculates that coal, due to increased cost per ton, accounts for £9350, and its inferior quality for £4500. The ash content of the coal, he declares, increased from 14 to 26 per cent. That is to say, over one-quarter of the fuel used was ash. No electrical engineer can in such circumstances be expected to get along satisfactorily. But really—though no one can dispute the Stepney 26 per cent.—it is a peculiar thing there should at this time be a perfect epidemic of highly excessive ash percentages in the coal supplied to electricity stations.

A Presentation.—Mr. Edward Masters, who has been connected with Messrs. Gibbons Bros., Ltd., for more than forty years, has just been presented with a handsome silver tea service, bearing the following inscription: "Presented to Edward Masters by his co-Directors of Gibbons Bros., Ltd., and B. Gibbons, Junr., Ltd., on the occasion of his seventieth birthday."

The Corbet Woodall Scholarship.—Mr. Charles Wood, F.C.S., Engineer and Manager of the Bradford Corporation Gas Department, has been appointed a member of the Corbet Woodall Scholarship Advisory Committee in connection with the University of Leeds, in succession to the late Mr. J. G. Newbigging, M.Inst.C.E., the Engineer to the Manchester Gas Department.

GAS-WORKS EMPLOYEES AND WAR SAVINGS.

By S. E. HALLIWELL, of Littleborough.

THE patriotic spirit manifested so unsparingly by the gas industry—not limited by the bounds of mere duty, but extended to the highest possibilities in the wider fields of effective service to "help on the war" in every possible way—is sufficient evidence that the importance of the national appeal for support of the War Loans is fully realized. The War Loans must be a success; and an Englishman worthy of the name does not consider sacrifice of time and money in determining his share of responsibility or service. To those who are more familiar with the nomenclature of the financial world, the terms commonly used in the ordinary prospectus do not present any terrorizing effect, nor do the many conditions of "conversion" and "redemption," the intricacies of income-tax deduction, or the methods of "allotment" or "registration" prove a stumbling-block. But it must be remembered that the individuals unfamiliar with these matters are chilled and bewildered by the ordinary unattractive and stereotyped financial circular. They want to know, in plain every-day English, "how much it costs," and exactly what is expected of them, in convincing and clear language, without any embellishment or rigid and icy phrases. This phase has evidently been realized; and the efforts of the National War Savings Committee are apparently centred on methods of popularizing which are simple and effective.

The establishment of Local Committees has undoubtedly been immensely successful in reaching this class of possible investor through the mill, the workshop, the school, or the club, by personal appeal to the patriotism of the individual, who in pre-war days considered Government Loans as quite outside his province altogether. Once make him realize his responsibility, by "hitting the nail straight on the head," showing the imperative necessity of "backing-up the boys at the front" by economy and subscription to the loan, the full attractiveness of the War Savings Certificates is more easily revealed; and a few such units work miracles among their mates. It is the plain duty of those who do not need convincing of the urgency of supporting the Government in their appeals to exert every possible effort, even though under disappointing circumstances, among all those with whom they come into intimate contact. Many of the thousands of working men who could easily contribute their quota (even though small) are not influenced by general Press appeals—not due to rank indifference, but to the mistaken impression that only the moneyed classes are interested—and only by personal appeal and explanation can they be convinced. Hence the value of local organization. Private and public lectures and talks are being organized to impress the absolute necessity for saving in "every item of expenditure not necessary for the efficiency and health of the individual," and the value of investing in the Government Loans for the successful prosecution of the war. The National War Savings Committee, in presenting their case to Local Organizations, state:

> In making an appeal for savings, especially to those whose income at best is limited in amount, propaganda and organization are all important for success. The would-be investor should not, if it can be avoided, be left to seek for an investment. Facilities for investment should be provided by agencies in close touch with him; and these agencies, having succeeded in inducing him to save, should endeavour, by careful propaganda and by thorough organization, to persuade him to make the continuance of saving a matter of habit.

The Committee on War Loans for the Small Investor urged:

> 1.—That there are many advantages in placing, between the small investor and the State, agencies which can collect and in some cases invest and manage savings.
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> 2.—That there is no reason why such agencies should not be extensively created by employers of labour, committees of workmen, and by other bodies formed specially for the purpose.

This is being extensively carried out, and could be readily adopted by all gas undertakings to appeal to the thousands of gas workers throughout the kingdom. Many schemes are devised which can be adapted to local circumstances; and the National Committee willingly supply any information for the benefit of inquirers. The admirable scheme adopted by the Birmingham Corporation Gas Department has already been noticed in your columns [*ante*, p. 243]. The sole idea underlying all the schemes is (1) to stimulate the sentiment and urge the need, and then (2) to offer simple and easy means for investment, assisted by those with whom they are in regular contact.

The War Savings Certificates seem to appeal most forcibly to the majority. The fact that the investor can obtain the return of his money at any time in case of need, on terms that are distinctly specified and guaranteed by the British Government, renders this class of investment most popular, although it may not in the long-run prove to be the most profitable security. The following extract from the "Official Handbook" will emphasize this point:

> Although the financial advantages of War Savings Certificates have been pointed out, it must be added that for the most part people are not induced to buy these certificates because they are the finest investment that there is, but they subscribe for them readily enough when they recognize that they are Certificates of Patriotism, the purchase of which is a direct contribution to the winning and the shortening of the war.
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> At the same time, it is appropriate to urge that it is a great advantage to most people to have some money available a few years hence. It

may serve to tide over the period of unemployment which may result from the re-arrangement of industry after the war. It may provide for the education or apprenticeship of children, and it will supply the means of purchasing, when the war is over, things which have been done without for the present, most likely at lower prices than have to be paid for them now.

The terms of issue of War Savings Certificates, as explained in lucid and simple language in the numerous leaflets published by the National Committee, are readily understood by any individual, no matter how little he may be versed in financial matters; and if supported by effective and personal canvassing, assisted by local organization for encouraging and receiving regular instalments, the result must be gratifying, and millions of pounds will be diverted for use by the nation which would otherwise have been untapped. Many cases of small hoards—even of gold—put away for use on a "rainy day," being brought out and utilized for the purchase of certificates, are reported by local canvassers, directly due to the influence of district organization. Not only does this influence the success of the loan, but it must have a salutary effect on the mind of the hesitant and sceptical investor, with his mistaken notions of thrift. If he is made to feel that he is doing his duty to his nation, in addition to providing for his future needs, then the result must be beneficial all-round.

Certificates cost 15s. 6d. each, and yield £1 at the end of five years from date of issue. They can be cashed for 15s. 6d. at any time within one year, and at later periods as follows:

15s.	9d.	at the end of	one year.	
16	9	"	two years.	
17	9	"	three	"
18	9	"	four	"
20	0	"	five	"

The rate of compound interest on the investment if cashed is:

At the end of	one year	.. £1 12	3	p.ct.
" "	two years	.. 3 19	1	"
" "	three "	.. 4 12	5	"
" "	four "	.. 4 17	6	"
" "	five "	.. 5 4	7	"

No income-tax is deducted from, or charged upon, the interest earned by the certificates, nor does the interest need to be included in income-tax returns. [Finance Act, 1916, sec. 42.] No individual may hold more than 500 certificates; but a man and every member of his family may hold up to 500 certificates each, without regard to the amount of income. The initial cost of certificates, and the value at the end of five years, is shown in the following table:

No. of Certificates.	Initial Cost.	Value at the End of Five Years.
	£ s. d.	£
1	0 15 6	1
25	19 7 6	25
50	38 15 0	50
100	77 10 0	100
200	155 0 0	200
300	232 10 0	300
400	310 0 0	400
500	387 10 0	500

This is a most effective table, and ought to be instrumental in impressing even the most backward contributor.

The value is considerably enhanced by the forming of Associations. For instance, if 31 people individually save 6d. a week for 31 weeks, they will each have a certificate at the end of 31 weeks, and not before. But if they join an Association to which they each pay 6d. a week, the Association will be able to buy one certificate each week; and at the end of 31 weeks they will have 31 certificates. The first of these certificates will be dated thirty weeks earlier than a certificate bought by any member acting alone and saving 6d. per week. The second certificate will be dated twenty-nine weeks earlier, and so on. On the average, they will be dated fifteen weeks earlier.

Associations can be formed by any number of people who are willing to work together to secure the attainment of its objects. Thus employees can form their own Association, to be worked by their own committee and officials, which must be affiliated to the National Committee; and application is usually made through the medium of the Local Central Committee, where there is one in existence. Otherwise the application should be sent direct to the National War Savings Committee. The procedure is fully explained in the "Official Handbook," which may be obtained from the headquarters, Salisbury Square, Fleet Street, E.C. This course has already been adopted by many gas undertakings—each station having its own officials, and the whole being managed from the head office, with a controlling executive in direct touch with the chief officials.

The most effective way is to obtain subscriptions by deductions from weekly wages. This can be effected by employees signing a request and authorizing such deductions, which must be entirely voluntary, and can be varied in case of necessity, such as sickness, &c. Financial assistance to Associations can be rendered by employers by the immediate purchase of quantities of certificates, to be issued to employees when the full amount has been paid by instalment, which gives the advantage of the earlier dating of the certificate and the more profitable return that in this way results.

In some cases, the certificates are issued to employees, through the generosity of the employer, at less than 15s. 6d. each. After the certificate of affiliation has been granted, the Association will be supplied free of cost with all the necessary books, rules, forms, and leaflets. No charge is made for affiliation. Alternative schemes of management and procedure are suggested, and lucidly outlined in the "Handbook," to meet the requirements obtaining in the various districts; and choice can be made of the most suitable.

The establishment of such Associations deserves every encouragement from the head officials of all gas undertakings, who, though sorely pressed under existing conditions, must realize the absolute necessity of "shouldering the wheel" in the "final push" for victory. Again quoting from the "Handbook:"

> The appeal of the National Committee is not to self-interest, but to the patriotism of the people; and on this ground—"with an assurance that what is lent will actually be used for the equipment and supply of our fellow-countrymen holding the trenches and keeping the high seas"—the appeal, if steadily pressed, cannot fail of success.

STATE CONTROL OF ALL COAL MINES.

THE action of the Government in taking over the coal-mines in South Wales for the period of the war, is now to be extended to all the coal-mines in the United Kingdom.

The President of the Board of Trade has decided to set up a new department, which will control the mines, and will also exercise the other powers and duties of the Board with regard to coal. Mr. Guy Calthrop (the General Manager of the London and North-Western Railway Company) will take charge of the new department. His official designation will be Controller of Coal Mines; and his office will be at No. 8, Richmond Terrace, Whitehall, S.W. Sir Richard Redmayne, K.C.B. (H.M. Chief Inspector of Mines), will assist the Controller; and the department will also be assisted by an Advisory Committee consisting of persons selected to represent coal owners and coal miners.

"The Times" says it is understood that State control of the mines will follow generally the lines of the scheme under which the railways are controlled, rather than those of the control of munition works. The basis of compensation in the case of the railways, however, could not be adopted without modification in the case of the mines; for a guarantee against loss on some pre-war basis would offer no incentive to an increase of output. An alternative which would not be open to this objection is the payment to the owners of a fixed sum for every ton of coal brought to the surface. This would involve a fixing of prices; and it is obvious, therefore, that the problem could not be settled in a hurry. It is thought that the financial arrangements of the transfer will be based on the second of these alternatives.

Institution of Civil Engineers.—At this evening's meeting of the Institution the paper to be submitted for discussion is one entitled: "The Commercial Metering of Air, Gas, and Steam," by Mr. J. Lawrence Hodgson, B.Sc.

Southern District Association of Gas Engineers.—The March meeting of the Association will, the Hon. Secretary (Mr. H. C. Head, of Winchester) states, be held at the Royal Society of Arts rooms, John Street, Adelphi, W.C., at 3 p.m. on the 8th prox. Afternoon tea will be served on the termination of the meeting; but the Committee have decided that, owing to the war, it is not desirable to have the annual dinner. The principal business of the meeting will be the induction of the new President (Mr. W. N. Westlake, of Exeter), in succession to Mr. W. Doig Gibb.

Gas Undertakings and Construction Companies in Massachusetts.—The Gas and Electric Light Commissioners of Massachusetts have issued an order, signed by the Chairman, to the undertakings under their jurisdiction, similar in tone to the usual provision in English Gas Acts—that the directors must not hold any other office under the company, or be personally interested in firms from whom purchases are made by the company. The Commissioners have viewed with concern the control of the directorate of certain companies by officials and employees of engineering, construction, and management organizations with which these concerns have from time to time contracted for extensive improvements and managerial services; and such practices are considered by the Commissioners as being wrong in principle. If justifiable in the case of public service companies whose credit is feeble and future hazardous, such justification ceases when the financial position is soundly established. The management should then be in the hands of directors and officials responsible solely to the stockholders and the public; and the concern should not have any dealings in purchase of supplies, materials of construction, or managerial services with firms in which members are interested as directors, leading officials, agents, or other substantial position, unless and except such purchases are effected by means of honourably conducted open competition. No company under the supervision of the Commissioners shall hereafter enter into arrangements of the character above indicated; and any such existing relationships shall not be renewed on expiration, save with the approval of the Commissioners under exceptional circumstances.

DISTILLATION PROCESS IN THE VERTICAL RETORT.

Investigations by Heeren J. N. E. Teune and P. J. Kummel at the South Gas-Works, Amsterdam.

[Abstract-Translation from "Het Gas."]

(*Continued from p.* 248.)

The figures given in Table I. [*ante*, p. 248] show that there is a continuous falling off in the production of ammonia from the fifth hour of carbonization onwards. Temperature determinations showed that at about the same hour the core of the charge of coal became considerably hotter. It therefore seemed desirable to make a trial run, in which steam was admitted at the low pressure of 0·6 atmosphere after the fifth hour of carbonization. The object was, by keeping the charge cool for a longer period, to increase the yield of ammonia. An increased production of water gas might be anticipated, but the temperature of the charge would be too low for economical water-gas production. On the other hand the earlier introduction of steam should have more effect in keeping down the temperature; and the coal gas should consequently suffer less, and so be richer in heavy hydrocarbons and methane. Thus there should be no depreciation in the quality of the gas produced as a whole. The result of this trial run gave a make of 14,888 c.ft. of gas per ton of coal; the gas having a gross calorific power of 537 B.Th.U. per cubic foot, and the following average composition, in volumes per cent.: Carbonic acid, 2·6; heavy hydrocarbons, 2·4; oxygen, 0·5; carbonic oxide, 13·2; methane, 20·2; hydrogen, 54·9; nitrogen, 6·2. Since the yield of gas was appreciably higher than before, and its quality worse, it was decided to make another trial run in different conditions.

Temperature readings were made at the same points in the core of the charge exactly as in the test of normal working [*vide* fig. 1. *ante*, p. 248], and the results are plotted in the curves given in fig. 2, A comparison of the curves in these two figures shows that the early admission of steam causes a reduction of the temperature of the charge; the greatest reduction being at the bottom. The average composition of the gas, in volumes per cent., was: Carbonic acid, 4·5; heavy hydrocarbons, 3·1; oxygen, 0·3; carbonic oxide, 11·4; methane, 20·4; hydrogen, 56·8; nitrogen, 3·5; and its gross calorific power was 554 B.Th.U. per cubic foot.

The composition of the gas made at each hour of this trial is shown in Table II. It will be seen that its quality as a whole is not appreciabiy lower. The proportion of carbonic acid is higher, and that of methane lower than in normal working—compare Table I. The percentage of heavy hydrocarbons is better; so that on the whole there is no considerable fall in calorific power. The make of gas is rather higher. It is noteworthy that heavy hydrocarbons still occur in the gas made in the eleventh hour, whereas in normal working they are then absent. The fact, thus confirmed, that by this mode of working a longer period is necessary for the distillation of the coal, shows that it is desirable on this account also not to admit steam in the last hour.

The trial having shown that this method of working did not lead to any appreciable falling off in the quality and quantity of the gas

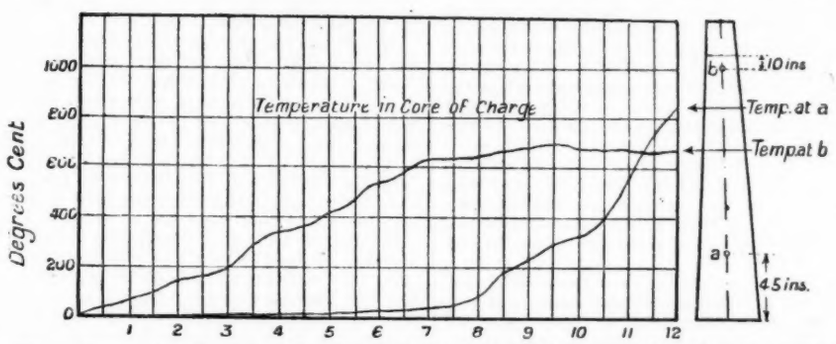


Fig. 2.—Temperature Reading at Two Levels in the Core of the Charge, when Steam is admitted from the end of the fifth hour to the end of the eleventh hour.

The lower quality of the gas was naturally ascribed to the greater formation of water gas; and it was decided, therefore, not to admit steam in the last hour, but to restrict the steaming from after the fifth up to and including the eleventh hour. In the last hour the coal would be worked off without the lowering of temperature caused by steaming. It further appeared, from a study of the gas production in each hour, that no increase of water gas formation in the later hours of carbonization would result from increasing the steam pressure, but that increase of water gas production would ensue only if the admission of steam were started earlier. This might be done with advantage when working-off coal which yields a rich coal gas, the calorific power of which would otherwise be too high.

When admitting steam at 0·6 atmosphere pressure from the end of the fifth to the end of the eleventh hour of carbonization, a make of 13,880 c.ft. of gas per ton of coal was obtained; the charge being fully worked off when discharged at the end of twelve hours.

made, it was repeated with a charge of exactly the same weight as before, in order to determine the effect on the ammonia yield. The results obtained for each half-hour throughout the period of carbonization are included in Table II. The total yield of ammonia was 0·3607 p.ct. by weight of the coal carbonized, which is equivalent to a make of 31·36 lbs. of sulphate per ton of coal. It is obvious from the tabulated results for each half-hour that the ammonia production increases as soon as steaming is begun at the conclusion of the fifth hour. The lowering of the temperature by this mode of working even gives a higher yield of ammonia in the last hour than is obtained in normal working. The increased yield of ammonia as a whole is equivalent to the production of sulphate per ton of coal being 19·86 p.ct. higher than in normal working.

The earlier introduction of steam, therefore, gave the following results: (1) Increased production of ammonia; (2) no change in the quality of the gas, though some change in its composition;

TABLE II.—*Composition of Gas at Each Hour of Carbonization; Steam at* 0·6 *Atmospheric Pressure being Admitted from the End of the Fifth to the End of the Eleventh Hour.*

Hour.	Composition of Gas in Volumes per Cent.							Ammonia, Ounces per 1000 C.Ft.	
	Carbonic Acid.	Heavy Hydrocarbons.	Oxygen.	Carbonic Oxide.	Methane.	Hydrogen.	Nitrogen.	First Half Hour.	Second Half Hour.
First	4·2	6·5	0·2	7·7	44·4	34·8	2·2	15·21	16·07
Second	3·8	5·6	0·2	7·6	37·0	43·2	2·6	15·59	14·62
Third	3·6	4·8	0·2	7·8	30·1	50·7	2·8	13·27	13·88
Fourth	3·0	4·8	0·2	7·8	29·5	51·6	3·1	11·86	12·31
Fifth	3·0	4·0	0·3	7·9	27·6	54·2	3·0	11·34	10·56
Sixth	6·4	3·4	0·4	9·2	18·4	58·6	3·6	13·24	12·42
Seventh	7·0	3·4	0·3	10·1	18·7	57·9	2·6	10·74	10·08
Eighth	5·8	2·2	0·4	9·6	17·0	61·0	4·0	9 21	7·69
Ninth	6 3	2·1	0·4	11·8	15·2	59·3	4·9	7·61	7·10
Tenth	6·0	1·4	0·6	12·9	13·0	60·4	5·7	5·23	4·50
Eleventh	5 5	0·5	0·6	15·7	8·1	65·3	4·3	3·19	3·02
Twelfth	0 8	0·0	0·4	16·8	4 5	72·5	5·0	1·50	0·60
Average	4·62	3·22	0·35	10·41	21·96	55·79	3·65	9·33	

(3) a slight increase in the make of gas. The trials with prolonged steaming made by the authors did not extend long enough to show whether the steam had any injurious action on the retort. Extended practical trials only could settle this point. Possibly it would be better in practice to start the admission of steam at the end of the fifth hour, and interrupt it after a few hours; and then readmit it during the last hours, so that the maximum heat of the coke may be utilized for the production of water gas.

ROUTE TAKEN BY EVOLVED GAS IN THE VERTICAL RETORT.

Investigation was next made of the reason why the gas evolved in vertical retorts suffers less decomposition than that evolved in horizontal retorts. According to the generally accepted theory, the coal in a vertical retort undergoes dissociation from the walls inwards to the core of the charge, and the gas evolved passes upwards through the cold core, where it suffers less decomposition than in the horizontal retort. In order to check this theory, a 1 in. perforated iron pipe was carried through the bottom door of the retort into the core of the charge. At first the gas streamed out of the pipe in large quantities; but the outflow diminished comparatively quickly until at the fifth hour of carbonization no outflow of gas could be observed. On taking the pressure in the pipe, the surprising fact was discovered that the gas in the pipe during the first hours of distillation was under very obvious pressure, although the pressure at the top of the charge of coal was kept at zero.

Pressure observations were next made by recording pressure indicators at two levels in the pipe—viz., (1) at 24 in. above the bottom door of the retort, and (2) at 78½ in. above it. These observations were made with the retorts working in the normal manner—*i.e.*, with steaming during the last two hours only. The pressure records showed that at 24 in. above the bottom door of the retort there was in the core of the charge at first a pressure of 40½-10ths, which fell to 16·10ths at the end of the first hour, to 6·5-10ths at the end of the second hour, to 5·5-10ths in the next hour, and to practically *nil* by the end of the fifth hour. At 78½ in. (2 metres) above the bottom door, the pressure in the core of the charge started at 26·10ths, and fell in one hour to 16·10ths, and in the second hour to 6·5-10ths, and then gradually to *nil* before the end of the sixth hour.

It appears clearly from these results that no pressure remains in the core of the charge after about the fifth hour, and that gradually the sealing layer of tar between the core and the wall of the retort disappears, so that the gas produced in the core during the latter stages of carbonization can likewise travel to the wall of the retort.

In order to measure the gas passing up from the core, a 2-in. perforated pipe was passed in the same way into the core of the charge, and connected with the experimental gas apparatus, while the connection between the retort and the apparatus was cut off. The gas which ascends close to the wall of the retort could then pass in the ordinary way to the hydraulic main, through the connection with the other retorts of the setting. The pressure in the interior pipe was the same as in the readings made with the 1-in. pipe. The gas evolved in the core of the charge amounted to 2275 c.ft. per ton of coal, which is equivalent to 16·61 p.ct. of the total make per ton. Over 92 p ct. of the gas evolved in the core came off in the first 4½ hours, and none was evolved from the core during the last two hours, when steam at 0·9 atmospheric pressure was admitted to the retort.

It is to be noted that, when water-gas production is proceeding, none of it passes out of the core, and consequently all of it travels along the wall of the retort. It is preferable in practice that the water gas should be produced at the outside of the charge, as the temperature in the core, according to the authors' measurements, is very unfavourable for the manufacture of good grade water gas. Actually, the steam can readily pass over the coke by the gap which is formed between the charge and the wall of the retort. Coal gas alone issued from the 2-in. pipe, and was measured as coming from the core of the charge. Leaving out of account the gas made in the last two hours (which the authors regard as being wholly water gas), and considering only the coal gas that was produced by distillation in the first ten hours, it appears that of this coal gas 22·37 p.ct. is evolved through the core of the charge.

The gas evolved through the core, as delivered from the 2 in. pipe, was collected in samples representative of each hour's production. The results of analyses of these samples are given in Table III. The volume of gas evolved through the core became relatively small in the fifth hour, and quite trifling subsequently. The most notable difference between these analyses and those given in Table I. [*ante*, p. 248] for the whole of the gas evolved is the higher proportion of methane in the gas evolved through the core. But it appears from the results that the gas which skims the sides of the retort is not appreciably inferior to that which is evolved through the core of the charge. The tar produced from the 2-in. pipe was also collected, and was found to be appreciably more fluid than the ordinary tar which collects in the hydraulic main. This points to less decomposition of the tar taking place in the core than elsewhere. If the whole of the gas were evolved through the core, the tar would presumably be of better quality, though the gas most probably would not be appreciably better. The sulphuretted hydrogen in the gas from the core is much the same as in the total gas from normal working of the retorts; and the figures given in Table I. may be taken as applicable to it also.

TABLE III.—*Composition of the Gas Evolved through the Core of the Charge.*

Hour of Carbonization.	Analysis of Average Sample. Volumes p.ct.						
	Carbonic Acid.	Heavy Hydrocarbons.	Oxygen.	Carbonic Oxide.	Methane.	Hydrogen.	Nitrogen.
First	4·6	6·0	0·4	7·4	45·9	32·7	3·0
Second	2 0	5·0	0·6	7·6	34·0	47·6	3·2
Third	3·0	4 2	0·4	7·2	35·0	47·9	2 3
Fourth	3 2	4·4	0·3	7·5	34·8	46·4	3·4
Fifth	3·0	4·0	0·3	7·7	33·0	49·3	2·7
Sixth	2·4	3·4	0·4	7·8	32·0	50·9	3·0
Seventh	0·8	2 0	0·4	7·8	27·0	58·8	3·2
Eighth, Ninth, Tenth	0·8	0·2	0·5	8·0	9·4	78 1	3·0

The analysis of the gas also being nearly identical, detailed figures for the ammonia in the gas from the core were not obtained.

The foregoing observations of the yield and composition of the gas lead to the conclusion that in the first four hours of carbonization gas is evolved through the core of the coal, which is not much better than the gas which passes up alongside the wall of the retort. The authors are of opinion that the formation of gas starts opposite the wall of the retort, and a part of the gas formed penetrates the core of the charge, where there is so far no resistance due to the separation of tar. The rest of the gas passes up direct alongside the wall. When, however, a cake of tar has been formed in the coal, which presumably occurs after the fourth hour of carbonization, the gas can more readily escape alongside the wall of the retort, and the evolution of gas through the core of the charge then comes to an end. This view has been confirmed by the result of a further test.

In this test the attempt was made to compel the whole of the gas produced to pass out through the core of the charge. The retort outlet to the other retorts was shut off, and the 2 in. pipe in the core of the charge was connected to the experimental works' apparatus, so that the gas formed would be forced to pass through the 2-in pipe to the latter. By the use of a steam-injector, a vacuum of 8 10ths of an inch was maintained in the 2 in. pipe. After the fourth hour of carbonization, the gas began to blow out from both the lid and the bottom door of the retort; while the vacuum in the 2-in. pipe fell to about 6 in., and the meter in connection with the pipe recorded no evolution of gas. The test was then stopped and the 2-in. pipe taken out of the retort. The holes in it were found to be clear, and the whole pipe was clean and free from tar deposits. Thus it seemed proved that the passages in the coal between the wall of the retort and the core of the charge had been gradually blocked through deposition of tar. The gas evolved in this test through the 2-in. pipe was analyzed and found as a whole to be of slightly lower quality than that produced in the normal working of the retorts. This seems to indicate that the gas which would have passed up alongside the wall of the retort, having been compelled to pass through the coal, had been kept longer in contact with the hot wall and coal, and had consequently undergone partial decomposition.

This test confirms the conclusion that the decomposition of the coal proceeds from the outside towards the core, and the gas produced ascends alongside the wall of the retort. When the retort is filled with coke, as it is towards the end of carbonization, there is a clear space between the coke and the wall of the retort. The gas can readily ascend through this space. There is, however, always considerable formation of retort-carbon in a vertical retort. The deposition of this scurf is greater at the lower than at the upper end of the retort.

The less dissociation of the gas in a vertical than in a horizontal retort is to be ascribed to the more rapid rate of flow of the gas, caused by the vertical retort being more nearly filled. Thus the time of contact of the gas with the hot walls is shorter than in a horizontal retort. The upper end of the vertical retort being cooler than the lower end, there is less separation of retort carbon in the upper part, because the gas is less subjected to dissociation. If the gas did, in fact, pass up from the wall of the retort through the core of the charge, it would, in the authors' opinion, be better to heat the retort throughout its length to a uniform temperature. But as these observations have shown that the gas actually ascends alongside the wall of the retort, the distribution of heat adopted—viz., that the upper part is cooler than the lower—appears to be right.

CONCLUSIONS.

The authors draw the following conclusions from their investigations:

1.—By altering the duration of water gas production, the yield of ammonia can be increased without appreciable depreciation of the quality of the gas.

2.—In a vertical retort the formation of gas proceeds from the wall towards the core of the coal, and the gas ascends directly alongside the wall. Only at the beginning of the distillation, when there are no tar deposits in the coal, is a portion of the gas evolved through the core of the charge. There is thereupon formed an annular cake of tar which advances by degrees to the core and then disappears.

3.—Less exposure of gas to high temperature has more effect in forming better tar than in improving the quality of the gas.

OIL-WASHING FOR BENZENE AND TOLUENE.

By W. G. ADAM, B.A., Manager of the Tar and Ammonia Products Works at Beckton.

IT may have been felt in some quarters that large firms, who should have been leading the way in experimental work on the oil-washing of coal gas, have either allowed the younger and smaller gas companies to do the pioneer work, or have been extremely modest and reticent in making public their results. This reticence has been evident by the absence, until recently, of any but the most meagre accounts of the results of the process, and this in spite of the fact that now for almost two years the Government Departments have recognized that it was the only way to augment the supply of benzene and toluene. A certain amount of this reticence must be put down to discretion under the Defence of the Realm Act, as it may not have been thought expedient, or in the best interests of the country, to locate at an early date the precise spot where large quantities of pure benzene and toluene were being produced. The recent numerous papers and discussions on this subject have tempted the author to seek permission to publish the results of work carried out during the last few years on gas-works plant.

These experiments, commenced in 1913, were undertaken to ascertain the effect of oil-washing on the illuminating power and calorific value, in addition to the sulphur and naphthalene content of the gas.

Experimental work was started with a rotary scrubber dealing with about 30 c.ft. of gas per hour, in which was determined the relative efficiencies of various wash-oils. The results obtained were confirmed on a plant dealing with 100,000 c.ft. daily, in which a number of washing fluids were used, and the effects on the gas recorded. This experiment furnished the necessary information for a plant dealing with 2 million cubic feet daily, which was put to work early in 1914, and shut-down in June, 1914. By arrangement with the Government Department concerned, the plant was again started in August, 1914, and full information as to the process was furnished in September of that year.

It has for many years been contended that the sale of benzene and toluene as gas at (say) 2s. 6d. per 1000 c.ft., was bad policy, both from the gas consumers' and the gas undertaking's point of view, as well as from a purely scientific and national economy standpoint. This is evident from a consideration of the value of these bodies when sold by the gallon. The price of a gallon of benzol has seldom been as low as 9d. during the last twenty years, and has usually stood at 1s. per gallon. Benzol when vaporized will provide about 40 c.ft. of gas per gallon. The gas consumer pays for this rather less than 1¼d.; and yet the gas company could obtain by its extraction ten times this amount, less the cost of extraction. From an illuminating power point of view, the benzene is valuable; but the days of candle power standards are past, and calorific value is fast becoming the universal standard. This has, of course, followed on the advent of the incandescent mantle. But how many gallons of benzene and toluene will be allowed to flow through the consumers' meters before it is recognized what a loss they mean to the country?

There are several causes which have tended to this state of affairs:

(1) The conservatism of the authorities.
(2) The stereotyped views of gas undertakings with regard to the recovery of bye-products.
(3) The absence of any extensive coal tar colour and drug industry in this country.
(4) The fact that the internal combustion engine was first run on petroleum.

The state of the coal tar and ammonia industry in the country is evidence of the second, and it may be put down as partly productive of the third. Gas undertakings have been content to sell their tar and ammonia liquor to the tar distiller, who has, in his turn, been content with the profits he made, in the absence of encouragement to take the risks of aniline dye manufacture. The fourth was due to the price of petroleum spirit—at that time about 6d. per gallon, compared with benzol at 9d. to 1s.

Benzol is undoubtedly a better fuel than petrol, for internal combustion engines. It gives increased power per gallon; and it gives absence of knocking. The alleged effect of the sulphur compounds and the sooting sometimes observed can be overcome by efficient manufacture and suitable adjustment of the carburettor. Had sufficient attention been given at the time to the use of benzol as a motor fuel, not only would the country have been less dependent on imports, but a far larger quantity would have at once been available for the production of explosives.

The petrol supply is in the hands of a few large firms which produce a standard article, while benzol is produced in small quantities spread over the kingdom, and the quality of the product varies. The fact that benzol for use as motor spirit could be produced at gas-works all over the kingdom would aid in the distribution; and a Benzol Association, to secure the advancement of the trade and the production of a standard product, could be instituted possibly in connection with some of the already existing Gas Associations.

While the removal of benzol from the gas effects a reduction of about 50 p.ct. in the illuminating power, the calorific value is only affected to about 5 p.ct. At 2s. 6d. per 1000 c.ft. this would be equal to 1¼d. for about 2 gallons of benzol. Other considerations have, however, to be taken into account, as the oil-washing may so reduce the calorific value that the make of gas per ton of coal has to be decreased in order to make a richer gas. Enrichment by means of oil gas, however, must not be overlooked; for calories from gas oil at 3d. per gallon are obviously very much cheaper than from benzol at 1s. At the same time, the calories are rarely reduced to such an extent as to necessitate any such enrichment. The sulphur content of clean gas consists of thiophene, carbon bisulphide, carbon oxysulphide, and mercaptans. The carbon bisulphide is the principal constituent—providing, as it does, about three-quarters of the total sulphur. It is possible to remove all these except the carbon oxysulphide by means of oil-washing; and the gas would then test about 10 grains of sulphur per 100 c.ft. On a large scale, it would be possible to secure the conditions necessary for the removal of all but 20 to 25 grains at no extra cost, as the expenses of the oil-washing process are already booked to the production of the crude light oil; and by the subsequent recovery of the CS_2 from the first runnings, the sulphur can be made to help to pay for the process, as unlike other methods of sulphur removal, this process does not destroy the impurities that it removes.

For many years prominent scientific men, and even some gas engineers, have never ceased to disparage gas because it contained the small amount of sulphur now permitted. One does not expect more than this from the theorist; but is it the best policy for a tradesman to decry the quality of his own and his neighbours' goods? Have any of these learned gentlemen ever considered what a dangerous thing the ordinary domestic match is? From a sulphur point of view, each little match is equal to 0·2 c.ft. of ordinary gas; and the phosphorus and antimony fumes which are also given off are in themselves dangerous poisons. In spite of this, we do not hear them talking of the dangers of lighting their cigarettes or pipes!

Thorough washing of the gas with oil will remove all but the last one or two grains of naphthalene. At this figure, no trouble is usually experienced. Half-measures will remove the naphthalene down to about 6 to 8 grains according to the temperature; but, unfortunately, the solvents and other heavy hydrocarbons are also removed. The naphthalene when deposited is then in prime condition for blocking the services. It is, therefore, a case in which half-measures must not be permitted; it being obviously better to strip a small quantity of gas thoroughly rather than a larger volume partially. The vaporizing (not spraying) of paraffin into the gas in sufficient quantity is an efficient preventative of the deposition of naphthalene from oil-washed gas—not, of course, by actual prevention of the deposition, but by the condensation of paraffins along with the $C_{10}H_8$ it is removed in a liquid form from the catch boxes.

Theoretical consideration led to the conclusion that the best wash-oil would be one which was of the maximum boiling point, consistent with sufficient fluidity at ordinary temperatures. This conclusion was verified on the plant treating 100,000 c.ft. of gas per day, in which the following materials were used as the washing medium:

(1) *Fluid Creosote Testing.*

Specific gravity . .	1·04
Tar acids	8·0 p.ct.
Distilling points :—	
10 p.ct. off	236° C.
20 ,, ,,	249 ,,
30 ,, ,,	262 ,,
40 ,, ,,	271 ,,
50 ,, ,,	290 ,,
55 ,, ,,	300 ,,

(2) *Fluid Creosote containing 2 p.ct. Tar Acids.*
(2A) Cresylic acid.
(3) *Heavy Pyridine Bases.*
(4) *Various Tars, including Oil Gas Tar.*
(4A) Mixture of green oil and oil gas tar.
(5) *Green Oil Testing.*

Specific gravity . .	1·0984
10 p.ct. off	276·5° C.
20 ,, ,,	291·0 ,,
30 ,, ,,	310·5 ,,
40 ,, ,,	323·0 ,,
50 ,, ,,	334·2 ,,
60 ,, ,,	345·5 ,,
70 ,, ,,	358·0 ,,
80 ,, ,,	371·5 ,,

Nos. (1) (2) and (3) gave very similar results both as to quantity of benzol, &c., absorbed, and quality of crude spirit obtained. Nos. (1) and (2) gave a crude spirit containing up to 25 p.ct. of the wash-oil, and considerable amounts of tar acids. As was expected, the tar acids readily distilled with the steam, and were found in the crude spirit; and a similar result, but to a less degree, was obtained with the heavy bases.

The various tars experimented with were all found to give low absorption of benzol, &c.; and it was determined that to secure efficient extraction, a very much larger quantity of tar had to be used than was produced per ton of coal. A consideration of the conditions prevailing on coke-ovens predetermined this point. Coke-oven gas frequently contains tar fog; and this is completely

absorbed by the oil in the scrubber. The repeated steam distillation of the oil gradually carries away the creosote, leaving behind the tar. The result is that after a time the oil becomes tar; is said to be "fatigued;" and has to be renewed.

No. (5) green oil was found to give absorption up to 6 and 7 p.ct., a crude spirit containing frequently as low as 5 p.ct. of heavy oil, and a low naphthalene content of the gas. It was thus found possible to obtain high efficiency in the absorption—less oil having to be circulated. This resulted in an increased capacity of the scrubber, heating, cooling, and distilling plant, and economies in both steam and cooling water. The crude spirit contained no tar acids, and thus required no soda wash prior to rectification. A low heavy oil content of the spirit gave economy of acid in the "C.O.V." wash, amounting usually to a 50 p.ct. saving. With the use of green oil and complete stripping of the gas, it was found possible to keep the naphthalene at 4 grains per cubic foot; and interesting results in the distribution of the gas were obtained. It was found that after the old deposits of naphthalene in the mains were removed, no stoppage (even in the smallest services) were experienced.

The following are a few tests on the gas taken haphazard during a run of about one month, when using green oil as the scrubbing medium on an experimental plant of about 100,000 c.ft. of gas per day capacity:

Illuminating Power.		Calories Gross.		$C_{10}H_8$.		Sulphur.	
In.	Out.	In.	Out.	In.	Out.	In.	Out.
13·7	5·5	138·6	129·1	8·8	5·8	38·0	18·0
13·4	3·8	135·5	126·9	10·4	1·5	40·5	19·0
14·4	5·8	137·3	129·5	11·8	3·1	35·4	17·6
14·2	3·9	137·1	128·4	6·7	0·7	45·0	25·0
15·3	7·2	135·0	128·0	6·4	Trace	35·0	17·0
15·2	6·6	138·3	126·7	6·4	Trace	36·4	18·1
14·1	4·4	133·3	124·6	6·7	1·0	39·0	18·0
14·1	4·8	132·3	125·7	5·4	0·9	30·2	15·4

Working on a two million scale, and using a rotary washer, the following interesting results were obtained:

Temperature of Oil.	Illuminating Power.		Calories Gross.		$C_{10}H_8$.		Sulphur.	
	In.	Out.	In.	Out.	In.	Out.	In.	Out.
76° Fahr. .	14·0	3·8	141·0	133·8	11·2	7·9	40·8	30·2
77 . . .	14·1	6·0	142·5	135·4	19·0	10·8	36·6	22·4
75 . . .	13·9	7·2	141·8	136·8	16·0	8·0	45·0	24·4
82 . . .	14·0	6·3	140·5	134·8	13·5	3·1	46·2	36·0
75 . . .	14·4	7·1	143·2	136·3	16·3	5·8	51·7	36·3
82 . . .	13·8	8·2	139·6	137·9	9·6	5·3	35·0	27·7

On the days corresponding to the above figures, the crude light oil obtained gave distillation tests as follows:

Start.	Percentage off at:					Specific Gravity.
	84° C.	100° C.	120° C.	145° C.	165° C.	
	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	
75° C.	30	85	90	93	94	·896
79	23	79	88	90	92	·8965
78	19	79	85	90	92	·894
76	20	83	89	93	94	·891
80	14	78	83	91	93	·893
73	29	86	90	91	93	·892

The oil-washing of coke-oven gas is usually carried out in the presence of ammonia, sulphuretted hydrogen, and other impurities. In this condition, the gas and the wash-oil have an energetic action on steel and wrought iron. For this reason, the plant has to be made almost entirely of cast iron. This action is possibly influenced by the presence of cyanogen. No corrosion of wrought iron or steel is experienced when clean gas only is scrubbed.

When the need for toluene became evident, and the large experimental plant was restarted in September, 1914, suggestions as to the best method of obtaining toluene without benzene were made; and at the same time the necessity of a quick method of estimating benzene and toluene in the crude spirit became evident. It was found that by reducing the amount of oil circulated per ton of coal, crude spirit containing a higher proportion of toluene was produced. The method of testing adopted involves only one fractionation, and can be applied equally well to purified benzols or toluols and to crude spirit. It can be carried out by the ordinary works' chemist, and it gives results which have been confirmed by the testing of mixtures of known composition, as well as by the actual fractionation of large quantities of crude spirit, &c. In order to carry out the test, 1000 cc. of the sample are distilled to 175° C., in an ordinary copper or glass still with the thermometer in the vapour—a simple form of column being used, to prevent entrainment. The distillate contains all the benzene, toluene, and solvent naphtha; the residue consists of creosote. The distillate is washed with alcoholic caustic soda to remove carbon bisulphide, and afterwards with "C.O.V." water, and alkali, to remove unsaturated bodies, bases, &c., dried over calcium chloride, and fractionated in a copper still using an eight-bulb Young-Thomas column. The distillation is here conducted at the rate of a drop per second. The following fractions are collected:

Up to 85° C. (a)
85° to 105° C. (b)
105° to 115° C. (c)
115° to 165° C. (d)

The specific gravities of the fractions (a) (b) and (c) are determined, and should approximate to 0·883, 0·878, and 0·868. Low specific gravities will indicate the presence of paraffins; and the amounts of these present can be sufficiently accurately ascertained from the specific gravities of these fractions.

Provided carbon bisulphide and water have been removed, the amount of benzene, toluene, and solvent naphtha contained in the material is given by:

Benzene . . . . . (a)+⅓ (b)
Toluene . . . . . ⅓ (b)+(c)
Solvent . . . . . (d)

Corrections for the paraffin content being made, the residue from the fractionation (consisting largely of heavy solvent naphtha) is added to the creosote fraction.

The Coal Question in France.

The subject of discussion at a recent meeting of the Committee of the Société Technique du Gaz was substitutes for coal in gas-making. It was decided to make experiments on the distillation of peat, about 6000 kilos. of which from the Somme are to be conveyed for the purpose to a works placed at the Society's disposal by M. Lesage. A report on the drying of the material, analysis of the gas, and the quantity and properties of the bye-products is to be presented. The branch of the Society devoted to manufacture and distillation, in view of the stoppage shortly of several works, has issued a memorandum setting forth in detail the measures which should most advisedly be taken in leaving works and distribution systems in a condition least subject to damage by lack of attention and least liable to danger to the public during this period and to the company on the resumption of operations.

Bituminous Coal-Gas Producer.

In the "Iron Age" [New York] was recently given an illustrated description of a re-circulating type of gas producer using bituminous fuel. This, says "Engineering," is the result of experimental work begun at the University of Wisconsin and continued at Purdue University. The coal is trapped-in at the top of the producer; the only air inlet being below the grates. The whole combustion takes place immediately above the grates. If three things are accomplished, the gas will be free from tar: (1) All tar must be driven out of the fuel while it is still above the openings which communicate with the annular chamber. (2) All the tarry vapours driven out of the fuel in the distillation zone must be drawn out and re-circulated. (3) The re-circulated gas must not be allowed to form a cold path for itself between the grates and the outlet on the one hand, nor form an explosive mixture with the entering air on the other.

The Weathering of Coal.

The Department of Mines in Canada have recently issued a report in which are set forth the following conclusions by Dr. J. B. Porter on the subject of weathering coal: (1) The presence in coal of complex and unstable carbonaceous compounds—such as resins, humus, &c.—promotes oxidation. (2) Pyrites and marcasite in coal are effective both as disintegrating agents and sources of heat. (3) The presence of moisture hastens the decomposition of pyrites. (4) Fine coal or coal dust presents a larger surface to the air in comparison with lumps. (5) An excess of air, while facilitating oxidation, also carries off the generated heat. When a limited supply of air reaches the coal, the destructive action is rapid. (6) A low pile ensures less pressure. (7) Individuality of coal is a prime factor. Dr. Porter emphasizes that dry coal is so poor a conductor that the surface may show no indication of a hot spot until after a rainfall. The water which has soaked in works its way back to the surface as steam, and reveals the fire within. A really important feature is the initial temperature of the coal at the time of storage. Coal should be handled during the coolest part of the day. Even in the temperate zone, the heat of the summer day makes it dangerous for coal to be stored while the sun is bright. This factor influences the storing of coal during the summer for winter use. After the storage is once effected, it is not so necessary that the sun's rays be deflected, since the heat absorbed during the day will be liberated at night. The loss of coal from fire in the second year of storage is approximately half that of the first year, because of the old surface protection.

There is to be a visit by members of the Scottish Junior Gas Association (Eastern District) to the tar-distillation plant at the Dundee Gas-Works next Saturday; and afterwards Mr. R. S. Johnstone (Dundee) will read a paper entitled "Régime of the Work Carried on in the Gas Engineer's Office." At the conclusion of the proceedings, the visitors will be the guests of Mr. Alexander Yuill (the Gas Engineer and Manager) at tea.

THE POSSIBLE PARTIAL SUBSTITUTION OF NITRE CAKE FOR SULPHURIC ACID IN THE MANUFACTURE OF SULPHATE OF AMMONIA.

By P. PARRISH, of East Greenwich.

INTEREST in the possible substitution of nitre cake for sulphuric acid in the manufacture of sulphate of ammonia has not altogether waned. This is evidenced by the paper read by Mr. R. J. Garvin to the Scottish Junior Gas Association (Eastern District), and by certain Technical Press comments thereon.

At the early part of last year, some suggestions were made as to the use of nitre cake in the manufacture of sulphate of ammonia. These suggestions, or recommendations, were adversely criticized by the members of the Coke-Oven Managers' Association, many of whom had made trial experiments on a more or less practical scale as to the feasibility of the proposals. Evidently, their experimental work suggested possible difficulties of manufacture, and irregularity of working, as alike doubt regarding the suitability of the ultimate product.

Indeed, the late Mr. G. Stanley Cooper, B.Sc. (whose premature death is deeply deplored by many who, not having actually made his acquaintance personally, were keenly interested in the merit and obvious quality of his many articles), in a paper that he read before the Coke-Oven Managers' Association, and published in the Technical Press in March last,* said: "The principal questions that arise are: (1) Can the mixed sulphate be sold? (2) How will the wear and tear of the plant be affected?"

He also doubted, as the result of experiments conducted several years ago, the possibility of being able to get a content of anything approaching 15 p.ct. of Na_2SO_4 in the mixed sulphate, and emphasized the futility and absurdity of producing the mixed salt with an acid content of 1·4 p.ct., owing to the destruction of the bags in which the sulphate would have to be packed.

The writer proposes to deal with these points, not by way of criticism, but in the spirit of—what he trusts may prove to be—helpful comment, in the hope that interest in this subject may be revived.

At the outset it is well to point out that nitre cake is the acid sulphate of sodium, which chiefly arises from the potting-ovens of sulphuric acid plants, and from nitric-acid plants. Nitre cake, originating from the latter sources, generally contains a varying acid-content of from 28 to 36 p.ct. of H_2SO_4, and a quantity of neutral sodium sulphate. Indeed, this must be the case, as the calculated H_2SO_4 equivalent of sodium bisulphate ($NaHSO_4$) is 40·8 p.ct. Nitre cake may be arsenical or non-arsenical in quality, according to the quality of acid used in decomposing the nitrate of soda. It invariably contains varying percentages of iron and alumina, according to its origin, and to the efficiency or otherwise of the dust-chambers, or flues of the burners, constituting part of the sulphuric acid plant. Nitre cake from nitric acid plants contains 0·3 p.ct. Fe_2O_3 and Al_2O_3, of which 40 p.ct. is the former constituent.

As regards the first question—the possibility of the sale of the mixed sulphates. Much centres on the proportion of Na_2SO_4 to $(NH_4)_2SO_4$, and on the economic aspect. Careful consideration suggests that certain limitations as to the percentage of sodium sulphate in the mixed sulphate would need to be imposed, quite apart from questions of practicability of the manufacture of the mixed salt and its utility as a manure. The writer's calculations lead him to fix the content of Na_2SO_4 in the mixed sulphate at 10 p.ct. maximum.

Presumably, sodium sulphate in the mixed salt can scarcely be regarded as of much manurial value or importance, except in so far as its indirect effect is concerned in rendering soluble other more important plant foods in the soil.

In this connection one can conceive of the soil water carrying down the dissolved sodium sulphate, and attacking the zoolitic double silicates in the clay, and a portion of their soluble bases, potash (K_2O) among them, displacing the sodium, and thus coming in solution.

One recalls the experiments at Rothamsted, where sodium sulphate was used along with superphosphate and sulphate of ammonia for wheat production resulting in increased yields of grain and straw. This was assumed to be due (and rightly so in the writer's view) not so much to the beneficial influence of the sodium sulphate as to the potassium salts displaced and rendered available for assimilation by the wheat.

Having had some experience of the manufacture and sale of artificial manures, and knowing the idiosyncrasies of the English farmer, the writer does not hesitate to express his conviction, in face of such testimony as that enumerated above, that little fear need be entertained as to the sale of the mixed salt.

Now as to the wear and tear of the plant. The lead work of the saturator is practically the only part of the plant likely to suffer by the use of nitre cake. Really, it is a question of the quantity of nitric acid released from the nitre cake used. Nitric acid has undoubtedly an injurious effect on lead. If, however, it is specified that the undecomposed nitrates in nitre cake are not to exceed 0·5 p.ct.—a limit not difficult of attainment—little trouble need be anticipated from this source.

* See "JOURNAL," Vol. CXXXIII., p. 523.

The figures in connection with the Rothamsted experiments are appended:

EFFECT OF ALKALINE SALTS UPON WHEAT CROP.

Plot.	Alkaline Salt added to Ammonium Sulphate and Superphosphate in Manure.	1852-61.	1862-71.
	Grain in Bushels.		
11	No alkaline salt	28·4	27·4
12	Na_2SO_4 added	33·4	34·3
14	$MgSO_4$,,	33·5	34·4
	Straw in Hundredweights.		
11	No alkaline salt	28·2	21·5
12	Na_2SO_4 added	34 2	30·5
14	$MgSO_4$,,	35·0	30·7

After all Glover tower acid is largely sold, and often unsuspectingly used, for the manufacture of sulphate of ammonia; and anyone familiar with the production of sulphuric acid knows it is not always possible to ensure a Glover tower acid free from oxides of nitrogen.

The writer inclines to the view that gas and coke-oven managers have been unnecessarily obsessed with the wear-and-tear aspect. The causes contributing to the deterioration of the lead work of saturators are only partially understood at the moment. Many peculiar experiences can be recorded. The writer has come across saturators built at the same time, and at the same works, made of the same strength and quality of chemical sheet-lead, worked under the same conditions, with the same quality of acid, without an ounce of nitre cake being used, and yet the condition of the saturators at the end of the same period of time was surprisingly different. One saturator was almost as good as new; the other in such a condition as almost to demand immediate renewal. On the other hand, the writer has worked a saturator for several years using nitre cake (in small quantities to keep the percentage of ammonia to 24) with apparently no injurious effects.

The form the cracker pipe takes, its posit on and arrangement of fixing, the absence or presence of a protejctive film of oil upon the lead inside the saturator, freedom from "rock salt," and the absence of oxides of nitrogen in the acid used—all these are important factors influencing the wear and tear of saturat ors.

Having now, it is hoped, allayed some disquietude as to the prospect of the sale of the mixed sulphate, and having indicated a few reasons why undue apprehension should not be entertained on the subject of wear and tear, perhaps it will not be inexpedient to examine the third aspect—concerning the extent to which nitre cake should be used as a substitute for sulphuric acid in the manufacture of ammonium and sodium sulphates, and the factors that govern its use. Taking nitre cake of an average acidity of 32 p.ct., one would expect to produce a salt of the double sulphates with an approximate analysis as follows (ignoring moisture, free acid, and the iron oxide and alumina content of the nitre cake):

$$2NaHSO_4 + 2NH_3 = (NH_4)_2SO_4 + Na_2SO_4$$

$(NH_4)_2SO_4$	= 48·18 p.ct.
Na_2SO_4	= 51·82 ,,
	100·00 p.ct.

Inasmuch as the relative percentages of free acid in pure sodium bisulphate and average nitre cake are as 40·8 : 32, so the proportion of ammonium sulphate producible will be reduced in the same numerical ratio:

$$40{\cdot}8 : 32 :: 48{\cdot}18 \text{ p.ct.} : x$$
$$x = 37{\cdot}8 \text{ p.ct. } (NH_4)_2SO_4$$

The analysis, therefore, of the double salt manufactured from average nitre cake (assuming the latter material is used exclusively) will be:

$(NH_4)_2SO_4$	37·8 p.ct.
Na_2SO_4	62·2 ,,
	100·0 p.ct.

The double salt has been prepared by the writer on the laboratory scale by passing ammonia, resulting from the distillation of ammonium hydrate, into a solution of nitre cake maintained at 212° Fahr., until the free acid in the solution was completely neutralized. The solution of the double sulphates was then evaporated, and white salt (not unlike finely ground salt cake in appearance) obtained, having the following chemical composition:

NH_3 8·8 p.ct.	= 34·100 p.ct.	$(NH_4)_2SO_4$
	0·005 ,,	Fe
By difference	65·895 ,,	Na_2SO_4
	100·000 p.ct.	

On conducting a similar experiment in the laboratory, but

substituting gas liquor for the ammonium hydrate, it was soon evident that complications would arise on the large scale. Either it would be impossible satisfactorily to "salt out," or if deposition of the fixed sulphates were effected then a neutral solution would result, ammonium ferrocyanide would be formed, and "blue salt" would eventually develop.

In face of these complications, the exclusive use of nitre cake must be dismissed as an unworkable scheme for most gas and coke-oven works, notwithstanding that the difficulties named are not incapable of solution.

As a matter of fact, two methods of working seem to be available. Either extraneous evaporation of the mixed sulphates in acid solution of about 6 p.c. H_2SO_4 would need to be resorted to, or it is conceivable that advantage could be taken of the principles of fractional crystallization, by which the respective sulphates of sodium and ammonium could be separately produced. These, however, are scarcely problems germane to the gas or coking industry, and may advantageously be left in other hands for their solution.

Experience of the manufacture of sulphate of ammonia reveals the fact that it is impossible to work with chamber acid of less than 105° to 106° Tw. (*i.e.*, 64·5 p.ct. H_2SO_4 content) without unduly accumulating mother liquor. If, therefore, nitre cake is to be dissolved in water, it is evident that there is a limit to the quantity of water which can be employed. It is equally obvious that the margin of latitude is distinctly narrow for those gas and coke oven works which use, or propose to use, a solution of nitre cake and which only receive deliveries of 70 p.ct. acid.

It was doubtless the knowledge of this matter which led the Sulphate of Ammonia Association to urge that the quantity of nitre cake by weight of acid should not exceed 10 p.ct.

Perhaps it will be expedient to determine what precisely the recommendation made by the Sulphate of Ammonia Association means. Their suggestion is the maximum use of 1 ton of nitre cake (say, of 32 p.ct. H_2SO_4 content) to 10 tons of 70 p.ct. acid. In other words, this means that 10·46 tons of 70 p.ct. acid would be available for the production of ammonium sulphate, and that there would be 0·68 ton of neutral sodium sulphate. Basing on practical considerations—namely, that 21 cwt. of 70 p.ct. acid are required to produce 1 ton of sulphate of 25 p.ct. NH_3 content—it would appear that:

$$\frac{10{\cdot}46}{1{\cdot}05} = 9{\cdot}94 \text{ tons of sulphate of ammonia 25 p.ct. } NH_3 \text{ content}$$

and 0·68 „ Na_2SO_4

or 10·62 „ mixed sulphate with 23·38 p.ct. content,

will result. These calculations ignore moisture and acid content in the mixed salt—an aspect to be dealt with later.

Examine now this recommendation from another point of view. Since 64·5 p.ct. H_2SO_4 is the lowest strength of acid which can be used without unduly accumulating mother liquor, the inference is clear that the availability of water for the dissolution of nitre cake per 100 tons of 70 p.ct. acid is only $70 - 64{\cdot}5, = 5{\cdot}5$ tons. As the recommendation of the Sulphate of Ammonia Association suggests, as a *maximum*, the use of 10 tons of nitre cake by weight per 100 tons of 70 p.ct. acid, it follows that 10 tons of nitre cake must be dissolved in 5·5 tons of water. This is impracticable. To dissolve 10 tons of nitre cake would involve the use of an excess quantity of water beyond the 5·5 tons, and except a dry steam coil made of lead were fixed in the body of the saturator to evaporate the superfluous water, introduced *viâ* the nitre cake solution, successful working would be well nigh impossible.

Reverting to the mixed salt containing 10 p.ct. of Na_2SO_4. It is distinctly fortunate that the majority of gas and coke-oven managers specify for the supply of 144° to 148° Tw. acid (*i.e.*, 78 to 80 p.ct. H_2SO_4). Hence the availability of an increased quantity of water for dissolution of the nitre cake.

It is known that a 50 p.ct. solution of nitre cake in water can be obtained if the temperature is raised to, and maintained at, 212° Fahr. The specific gravity of such a solution is roughly 116° Tw. at 60° Fahr.; and the acidity of it will be about 16 p.ct. H_2SO_4. Appendix 3 shows, however, that only 10·75 tons of water are available for the dissolution of the nitre cake; and as experience on the large scale has shown that a 50 p.ct. solution is the best and most desirable one, it follows that only 5·37 tons of nitre cake can be dissolved in the water available, whereas actually 14·7 tons of nitre cake should be used (see Appendix 2).

It is evident that on the large scale it is impracticable to produce a mixed salt with 10 p.ct. of Na_2SO_4 content *viâ* a water solution of nitre cake. Indeed, if only 5·37 tons of nitre cake of 32 p.ct. H_2SO_4 content can be used, it is clear that the mixed salt would have the following approximate chemical composition:

3·65 p.ct. . . . Na_2SO_4
96·35 „ . . . $(NH_4)_2SO_4$

What, then, is the solution of the problem? Careful reflection suggests two possible courses: (1) Introductien of the nitre cake in a ground but solid form to the saturator, or (2) introduction *viâ* the feed acid to the saturator.

The first method involves a mechanical feed of delicate adjustment for the ground nitre cake, and suitable attachment of such an arrangement to the saturator. As its adoption would, presumably, be reluctantly entertained, except by managers of large works, this method will not be further commented upon.

The second method is the one which doubtless will find most favour, as it can be easily applied. As far as the writer can ascertain, the solubility of nitre cake in sulphuric acid of various strengths has not been determined. Information on this aspect would be exceedingly useful to those using, or who contemplate using, nitre cake.

It is one of the "tricks of the artificial manure trade" to dissolve all the nitre cake produced at the "potting ovens" of the sulphuric acid plant in the chamber acid, which in turn is used for calcium superphosphate manufacture, and thus secure a profitable outlet for this erstwhile "drug of the market."

Nitre cake is similariy disposed of (but not so surreptitiously) by those sulphuric acid manufacturers who have adopted nitrate of soda sprays as the means of feeding the acid chambers with the requisite quantity of oxides of nitrogen. The sodium nitrate, by this method, is dissolved in water and sprayed usually into a short front chamber by means of compressed air.

The acid vapours react with the solution of nitrate of soda, generating oxides of nitrogen, which intermingle with the SO_2 and O_2 and are thence drawn forward to the other condensing chambers. The nitre cake resulting falls into the bottom chamber acid and is dissolved therein.

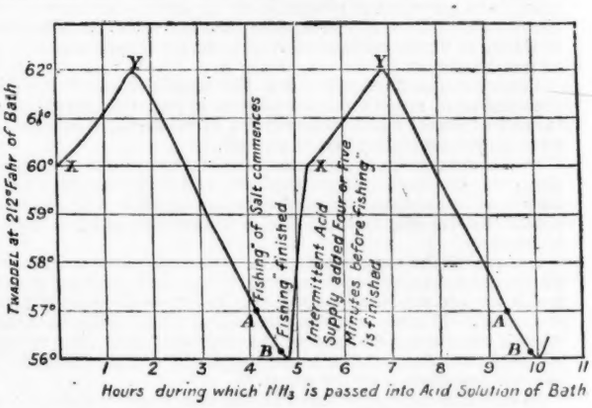
One would suspect that the solubility of nitre cake would be greater in a weaker acid, and *vice versâ;* and from rapid trials in the laboratory it would appear this assumption is not incorrect. At any rate 15 grams of ground nitre cake (32 p.ct. H_2SO_4 content) were taken and dissolved in 100 grams of 70 p.ct. acid, and a further 15 grams of the same ground nitre cake were dissolved in 100 grams of 80 p.ct. acid. A complete solution was obtained in 70 p.ct. acid at a temperature of 90° C., and in the 80 p.ct. acid at 98° C. On cooling, incipient crystallization was observed at 35° C. in the case of the 70 p.ct. acid and at 60° C. in the case of the 80 p.ct. acid.

Subsequent experiments indicated the practicability of dissolving 17 grams of nitre cake (32 p.ct. H_2SO_4 content) in 100 grams of 70 p.ct. acid. This is approximately the ratio necessary to admit of the manufacture of the mixed sulphates with a 10 p.ct. content of Na_2SO_4. As a matter of fact, for the production of the mixed salt of the quality named, 14·7 tons of nitre cake must be dissolved in 87·8 tons of 70 p.ct. acid, which gives a percentage of 16·5, thus:

$$87{\cdot}8 : 100 :: 14{\cdot}7 : x \therefore x = 16{\cdot}5 \text{ p.ct.}$$

It is preferable to break the nitre cake into small pieces, and to introduce it into a lead-lined tank provided with a suitable grid arrangement, and a closed lead steam coil, the tank to be of such capacity as is equal to twelve hours' requirements of acid. Two such tanks should be provided, so that the operation of dissolving the nitre cake in the 70 p.ct. acid (which takes at least some time) can proceed simultaneously with the feeding of the saturator with the acid solution of nitre cake from the other tank. The tanks should be placed in close contiguity to the saturator, and the outlet pipes and valves so arranged that no trouble arises from crystallization of the nitre cake solution, which occurs at about 48° C. To avoid the latter trouble, the solution, of course, is run to the saturator at a temperature of 212° Fahr.

On passing the ammonia gas into the acid solution of nitre cake, due to the greater solubility of the $(NH_4)_2SO_4$ than Na_2SO_4 in acid solution, the sodium sulphate first deposits, and the acidity slightly increases. Thus the acidity of the bath on large-scale operation working with the solution in question showed at the outset 15 p.ct. H_2SO_4 by titration. But as the absorption of the ammonia gas proceeded, the acidity gradually increased from 15 to 16·2 p.ct.,



and was then slowly reduced until 6 p.ct. acidity was reached, when "fishing" took place, and more of the feed solution was added. The latter, of course, represents intermittent working, and is somewhat analogous to the phenomenon (elucidated in the accompanying diagram) which has doubtless been observed by many who have operated sulphate plants of the intermittent "fishing" type, when using acid only for the feed.

The curve shows that the bath has a specific gravity at 212° Fahr. of 60° Tw. when the ammonia gas is first admitted to the saturator; but, due to the absorption of the ammonia by the acid, and the presence of excess acid, the specific gravity increases during the first hour or so. Afterwards, neutralization has taken place to such an extent that the acid can no longer hold the ammonium sulphate in solution; and hence deposition of the salt

commences, and the specific gravity is reduced gradually until, shortly after the fourth hour, the Twaddel of the bath is 57°—a specific gravity at which "fishing" is advisable.

This operation starts at the point A, and occupies about half-an-hour, by which time the specific gravity is almost 56° Tw., and the acidity about 5 p.ct. H_2SO_4. Then just prior to point B being reached, a fresh supply of acid is added gradually, so as to prevent any possibility of local alkalinity arising.

With experience and careful operation—especially with a continuous feed of the acid solution of nitre cake—a fairly uniform mixed salt can be produced free from undue acidity.

The late Mr. J. G. Newbigging, of Manchester, two or three years ago unmistakably demonstrated that sulphate of ammonia of an acidity of 0·5 p.ct. was immune from action on the bags.

Apropos of the question of the free acid in sulphate, it may be remarked that, even with an exclusive acid feed, some works produce and sell their produce with an acidity as high as 0·9 p.ct. of H_2SO_4, whereas other works have no difficulty in consistently producing a salt with not more than 0·25 p.ct.

The writer, in dealing broadly with this subject, does not wish the impression to be formed that he advocates the use of nitre cake under ordinary circumstances. It is merely as an emergency method, in order to release supplies of sulphuric acid which are urgently required in other directions that he suggests its temporary adoption, and endeavours to make a rejoinder to the adverse criticism which has perhaps been too indiscriminately hurled at certain recommendations concerning the use of nitre cake for the purpose in question.

APPENDIX.

(1) On a practical working scale 18 cwt. of 80 p.ct. sulphuric acid and 21 cwt. of 70 p.ct. are required per ton of ammonia sulphate of 25 p.ct. NH_3 content.

(2) Content of, and requirements for, 100 tons of mixed salt with 10 p.ct. Na_2SO_4 content:

Content.	Nitre Cake (of 32 p.ct. H_2SO_4) Required.	Acid 70 p.ct. Required.	Acid 80 p.ct. Required.
10 tons Na_2SO_4 . .	14·7 tons	..	..
90 tons $(NH_4)_2SO_4$.	..	94·5 tons	82·7 tons

N.B.—As the 14·7 tons of nitre cake (with 32 p.ct. H_2SO_4 content) is equivalent to 6·7 tons of 70 p.ct. acid, or 5·86 tons 80 p.ct. acid, obviously only 87·8 tons of actual 70 p.ct. acid, or 76·84 tons of actual 80 p.ct. acid, will be required to produce 100 tons of mixed sulphate with 10 p.ct. Na_2SO_4 content.

(3) Quantity of water available for the dissolution of the nitre cake in the manufacture of 100 tons of mixed sulphate with 10 p.ct. Na_2SO_4 content. A minimum strength of acid of (say) 65 p.ct. is required to produce sulphate of ammonia without accumulating mother liquor. Therefore if 78 to 80 p.ct. is used, 14 tons (say) of water are available per 100 tons of 80 p.ct. acid employed. As only 76·84 tons of actual 80 p.ct. are required, the quantity of water available for the dissolution of the nitre cake is:

$$100 : 76{\cdot}84 :: 14 \text{ tons} : x$$

$$x = \frac{76{\cdot}84 \times 14}{100} = 10{\cdot}75 \text{ tons of water.}$$

A NEW METHOD OF EXTRACTING THE VAPOROUS CONSTITUENTS FROM COAL GAS.

By R. LESSING, Ph.D.

IN the "JOURNAL" for Jan. 16 reference was made to a communication on the above subject by Dr. R. Lessing to last month's meeting of the Society of Chemical Industry. A week since—depending on an interesting summary of Dr. Lessing's proposal in our contemporary "Engineering"—we gave further particulars of his apparatus and mode of working. To-day, as the text of the paper appears in the last-issued number of the Society's "Journal," we are enabled to reproduce it in full. For convenience of reference we print a similar illustration to that on p. 296 of the "JOURNAL" for Feb. 13.

The recovery of benzol from coal gas is a problem which has engaged the attention of the carbonizing industry for the last fifty years. A good account of its early development—in which men like Cusiter, H. Caro, J. Hardman, G. E. Davis, and F. Carvès appear as pioneers—is given in Lunge's work "Coal Tar and Ammonia." The process was first practised in the English "carbonizing" works; then taken up by the bye-product coke-oven industry; and reintroduced into this country by Continental coke-oven builders. The gas industry a few years ago became interested in the recovery of benzol from gas as a means of augmenting the supply of motor fuel; but the statutory requirements of illuminating power stood in the way of its adoption on an appreciable scale.

While the way had been paved, by the fixing in a few individual cases of a calorific standard—the more rational one in view of the growing importance of coal gas as a heating agent—it took the stern demands made by the present war to sweep away old traditions and idiosyncrasies, and to make the valuation of gas on a calorific basis more general, or, at any rate, indemnify gas undertakings against deficiencies in illuminating power where they are caused by the extraction of benzol and toluol for munitions purposes. Under these conditions, created by the war, benzol extraction was taken up by many gas undertakings, and to an increased extent by coke-oven works not previously practising it.

The principle of the process is practically the same in all plants, although they may differ in details of design and working. It consists of scrubbing or washing the gas with an absorbent oil, and subsequently distilling the absorbed hydrocarbons from the "benzolized" oil and returning the "debenzolized oil," after cooling, to the scrubbers or washers. The scrubbers used are in the main of three types: Tower scrubbers filled with more or less efficient packing material; mechanical washers of the horizontal or vertical type; and bubbling washers of the Livesey type. As to stills, a great many varieties of design are in use, many of which are capable of improvement by the application of a more thorough study of the physico-chemical laws involved. Oils from coal tar, blast-furnace tar, shale, and petroleum are being used as absorbents; the most important ones being creosote oil, green oil, and gas oil. Undistilled tar is also used, as originally proposed by Friedlaender and Quaglio [English patent, No. 4888, April 1, 1887]*; and in that case the distilling plant can be dispensed with, as fresh tar is produced at the works and the benzolized tar is worked-up by the tar distiller. As the boiling range of tar is a very wide one, it may act at the same time as a scrubbing and carburetting agent; and to low absorbing efficiency, on account of high water or carbon contents, is frequently added the risk of the gas picking up additional naphthalene from the tar.

The adoption of a process which dispenses with a distilling plant in preference to the more efficient method of washing with oil in a continuous cycle, exemplifies a certain justifiable reluctance on the part of managers of small or medium-sized gas-works to add the duties of chemical manufacturers to their manifold responsibilities. It was, therefore, considered as desirable to devise a process of benzol recovery which should combine extreme simplicity in design and working of the plant with a fair degree of efficiency.

The use of a "dry" scrubber filled with a solid absorbent material, which would strip benzol from the gas without the employment of running wash-oil, and from which the volatile products could be removed by steam distillation *in situ*, appeared to offer a solution of the problem.

I had observed a number of years ago in the analysis of spent oxide that it was difficult to obtain constant figures when endeavouring to estimate its moisture by passing a current of dry coal gas over it. I explained these results, even at that time, by the absorption of hydrocarbons and carbon disulphide in the gas by the free sulphur, and particularly by the tarry matter in the spent oxide. On searching the literature I find a similar observation had been made with American spent oxide, by Goodno ["Gas World," 1893, Vol. XVIII., p. 296]. However, I did not consider spent oxide a suitable material either for the absorption or for the distillation phase of the process. This opinion has since been confirmed with regard to the absorption of carbon disulphide on the practical scale by Teune in experiments carried out at the Amsterdam Gas-Works ["GAS JOURNAL," 1915, Vol. CXXX., p. 334].

It appeared to be necessary to find a material of greater and more definite absorptive power, and one which should offer considerably less back-pressure than spent oxide would do and not be subject to chemical side reactions. It was found that the illuminating power of coal gas could be greatly reduced by passing it through a tube charged with pitch crushed to the size of a pea. It was, however, observed that the sharp-edged pieces became rounded, and that the pitch started "squatting" and finally "running" as soon as its viscosity had decreased sufficiently by the absorption of its solvents from the gas. This showed that it would be impossible to pack a scrubber with it, as it would tend to consolidate and block the passages, even if the temperature were kept low enough for the original pitch to remain rigid.

It was, therefore, necessary to supply a rigid support for the absorbent material. While pitch had been selected on account of the high viscosity both of itself and its solution in carbon disulphide, benzol, toluol, &c., it was found in the course of further experiments that oils of fairly low viscosity could be incorporated into highly porous inert materials without being unduly thinned or washed-out by the solvent vapours from the gas. While, therefore, in the usual methods of washing or scrubbing gas with oils, the gas is caused to bubble through a body or pass through a shower or rain of washing liquid, it was found possible to charge scrubbers with oil carried on an inert and rigid support, allowing it to remain quiescent, and indeed to behave as a solid,

* See "JOURNAL," Vol. CXXXVI., p. 287.

as far as contact with the gas and the production of back-pressure is concerned. The absorbed compounds can be liberated from their solution in the oil, *in situ*, by steam distillation, and to this phase of the steaming process apply the same considerations regarding the exposure of a large surface and avoidance of back-pressure, as to the scrubbing period.

On this basis, the following process was devised: The gas is passed through a closed vessel which contains porous material soaked in a suitable oil—for instance, green oil or gas oil. The inert material may consist of broken, highly porous brick or, preferably, of moulded pieces of definite shape, volume, weight, and available surface. The vaporous compounds in the gas in which the oil is soluble—*i.e.*, the hydrocarbons and organic sulphur compounds, which, when isolated, are liquid at ordinary temperature, are absorbed. When the oil has taken up the required amount of the substance to be extracted, which will depend on the quantity and surface of the absorbing agent, the velocity and volume of the gas, the temperature and degree of its saturation, the mutual solubility of the vapours and the absorbing oil, and the vapour pressure of the solution formed, the gas inlet and outlet valves are closed; the gas current being directed into the second vessel of the series. Steam is then blown through the material, carrying the vapours of the absorbed compounds with it to the water-cooled condenser, and finally to a receiver fitted with overflow pipes for water and crude benzol respectively. It is advisable to provide the "scrubber-still" with a jacket to avoid the condensation of steam, particularly on the walls. It is, however, not necessary to raise the whole of the inert carrying material to the temperature of distillation. As the oil forms a very thin film, and is, therefore, completely exposed to the passing steam, the volatile matter dissolved in it is distilled-off before the non-conducting support is raised throughout its mass to the same temperature.

When the distillation is finished the steam is shut off, and the vessel is cooled by passing water through the jacket. It is then ready for the next scrubbing period. By employing three or more sets of "scrubber-stills," they can be worked in rotation; a definite schedule being arranged for the three periods of scrubbing, steaming, and cooling.

It will be seen that the labour involved is restricted to the manipulation of valves for changing-over from gas to steam and *vice versâ*, and to the collection of the distillate. As there are no pumps or other moving parts involved in the process, nor adjustments of the flow of oil, the plant does not require any attention except for the change-over from one period to another. The steaming has to be done only once in twenty-four hours, or at even longer intervals, and occupies only a fraction of the time available for scrubbing. The ground-space required is, if anything, smaller than that occupied by the usual combination of scrubbing and distilling plant. Losses of oil are restricted to the portion distilled-off with the steam, particularly if superheated steam is used. In places where the crude benzol is fractionated, this oil can be returned in the form of residue. Elsewhere it is replaced by fresh oil, occasionally introduced through the top of the scrubber and allowed to soak into the material on its way to the bottom, where any excess is drawn off through drain-cocks.

The efficiency of scrubbing or washing carried out in the customary way depends on constantly breaking-up the oil into small drops or thin films, in order to expose new surfaces, and likewise upon deflecting the gas currents at short and frequent intervals to avoid the formation of inactive cores in bubbles or streams. In the proposed method, all the oil is exposed in a thin film, into the body of which the gas can readily diffuse, and which, therefore, does not require breaking-up or turning-over.

Thickening of the wash-oil in ordinary scrubbers is a disadvantage on account of the less intimate contact caused by a rise in viscosity. In this process, provided the solubility is not impaired, the thickening of the oil is rather an advantage, as a more viscuous oil is more readily retained by the porous material than a thinner one; while the area of the oil film exposed to the gas and steam respectively remains unaltered.

The interaction of gas and oil further depends on time-contact. Assuming equal rates of gas passage and equal scrubbing surfaces of a "dry" scrubber and an "irrigated" scrubber, a certain volume of gas would remain in contact with oil for about the same time in both cases. On the other hand, the oil in the "dry" scrubber will remain in contact with gas throughout the whole scrubbing period, while the contact of each particle of oil passing through the "irrigated" scrubber or through a washer depends on the rate of flow, which varies in wide limits with different constructions. But it is always considerably shorter than that of the quiescent body of oil locked-up in the "dry" scrubber. Consequently, the oil in the latter has a chance to saturate itself with the vapours from the gas to the maximum limit of the permissible vapour pressure of the solution formed. The latter is more concentrated near the gas inlet than towards the outlet; and if the vessel is divided into compartments, or several vessels are arranged in series, one will be completely saturated while the following ones act as check-vessels. It is thus only necessary to steam the completely saturated vessel while the second and third become Nos. 1 and 2, respectively, in the series.

Pending the elaboration and thorough testing of the process on a works scale, I have constructed an experimental apparatus for analytical and research purposes, based on the same principle, which has proved useful in this class of work during the last two years. The need for a simple and reliable method of controlling oil-washing operations has been expressed on various occasions lately; and I have, therefore, been encouraged by the Ministry of Munitions to publish the details of this method.

None of the purely chemical methods which have been proposed from time to time has been found satisfactory for the control of benzol-extraction plants in gas and coke works. The most accurate physical method is probably the freezing-out of the condensible hydrocarbons. This was proposed by St. Claire Deville ("Journal des Usines à Gaz," 1889), who extracted benzol and its homologues by passing from 10 to 20 c.ft. of gas through glass coils placed in a freezing mixture at $-22°$ C. and weighing the condensate. He had also determined the quantity of benzol required to saturate the gas at that temperature by further cooling it to $-70°$ C.

Lebeau and Damiens ("Comptes. Rendus," 1913, Vol. CLVI., pp. 144, 325) devised a method for the fractional distillation of liquefied coal gas on the lines of the researches of Ramsay and Travers. This method was amplified by Burrell, Seibert, and Robertson ("United States Bureau of Mines Technical Paper," 104, 1915).

While exceedingly useful for the estimation of the permanent gases and the total quantity of vapours—if such a distinction be permitted—these methods deal with quantities too small to allow of a separation of the vapour mixture into its components. These are, therefore, lumped together into one figure representing "compounds having an inappreciable vapour pressure at $-78°$ C.," and their volume in uncondensed form amounts to only about 1·5 p.ct. of the total. Their further treatment is, therefore, out of the question.

H. F. Coward and F. Bailey (Transactions of the Manchester Literary and Philosophical Society, 1916, XXIV.) pass a current of gas through a tube immersed in a mixture of solid CO_2 and ether for the purpose of estimating the illuminating power of the stripped gas on the lines of St. Claire Deville's experiments.

While all these methods are very valuable for purely research purposes, the apparatus is complicated and costly, and requires skilled manipulators. Besides, the quantities of liquid hydrocarbons obtainable in reasonable time are too small for practical purposes.

The method most widely adopted for works' purposes is the passing of gas through a train of wash-bottles charged with tar oils or petroleum oils of various description. The gas is passed at the rate of about 1 c.ft. per hour. The first bottle in the series is emptied twice a day, charged with fresh oil, and placed at the end. The oil from all the bottles is collected and distilled in a metal retort, with the aid of steam for the fractions above 130° C. On account of the back-pressure caused by the oil, and the low scrubbing efficiency of most types of wash-bottles, the rate of gas cannot be increased, and a complete test of 100 c.ft. of gas consequently takes practically five days.

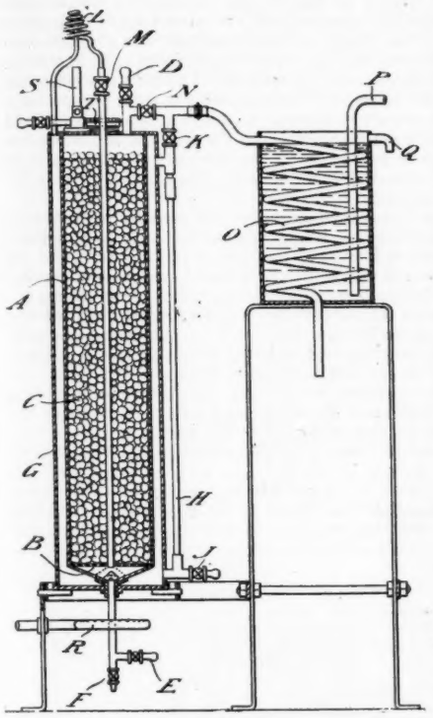
On account of the bubbling, the stream is not constant; and if the gas is to be tested for calorific value or illuminating power, it has to be collected in a holder to obtain a steady flame. At best, absorption in wash-bottles is attended by the drawbacks of rubber connections and leaks in stoppers.

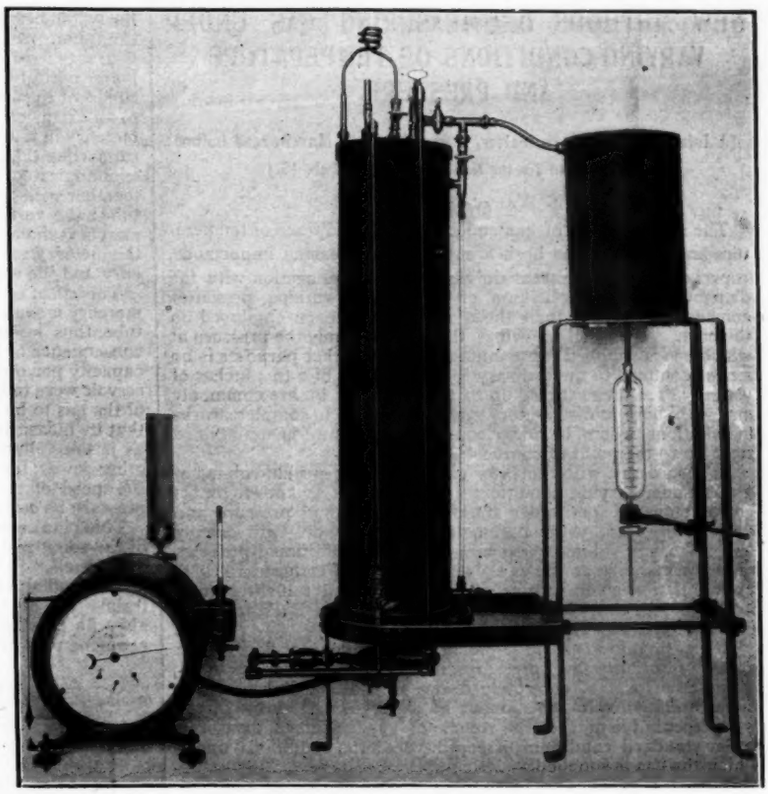
The method to be described overcomes these difficulties. Fig. 1 is a diagrammatic section, and fig. 2 is a photographic view of the apparatus. The container A is filled with the oil-soaked inert material C, which rests on a perforated bottom B, and exerts only a negligible back-pressure to the gas. The gas to be tested enters through the stop-cock D, passes downwards through the material, and through the gas outlet E into the gas-meter. I prefer to arrange the gas-meter after the scrubber, in order to avoid condensation or extraction of vapours in the meter. In most cases it is also more convenient to relate the results to totally extracted gas as a basis. The use of rubber tubing should be avoided as far as possible.

After leaving the meter, the gas may be used for any further chemical or physical examination required. Or else it may be burned; and it then indicates, by its almost entirely blue flame, the satisfactory working of the scrubber. It burns with a perfectly steady flame; and if the burner is arranged on the lines of a jet photometer, the length of flame, when compared with that of the unstripped gas, will give a direct (though somewhat empirical) measurement of the extracted hydrocarbons. Only the inner cone of the flame shows a small amount of luminosity, which is due to the non-condensible illuminants—such as ethylene, propylene, and acetylene, and to the small amount of vapour due to the vapour pressure of the solution formed, which is constant for any given temperature.

The container is surrounded by a jacket G, which is provided with a gauge H and drain cock J, and is filled with water during the scrubbing period. The gas is passed through the apparatus at the rate of about 5 c.ft. per hour; and about 100 c.ft. are used for one experiment. This will, therefore, cover a period of twenty hours, during which the apparatus does not require any attention at all.

Stop-cocks E and D are then closed; K is opened; and the water is run out through the drain cock J until it fills only about one-third of the jacket. A gas ring-burner R is then lit, and steam is raised in the jacket—the excess steam escaping through the condenser O. When the water is well boiling, K is shut, and the stop-cocks M and N are opened; the pressure having been relieved from time to time through N. At the same time the bunsen burner S is lighted. The steam raised in the jacket now passes through the superheater coil L and stop-cock M, to the bottom of the inner container, and up through the absorbent





material. The steam and vapours pass through N and the condenser O, and are collected in a graduated separating funnel clamped to the stand under O. P is the inlet for the cooling water and Q its overflow. The charging-hole T, through which the material is put into the apparatus, is closed by a screw-cap. Any water condensing in the vessel or surplus oil is drawn off through the drain cock F.

The steam distillation, including heating-up, takes from an hour to an hour and a half, and is usually carried on until the absorbed naphthalene is distilled over. To avoid blockages in the condenser, it is advisable to allow the cooling water to get hot before the naphthalene stage is reached.

By drawing off the hot water, and running cold water through the jacket, the apparatus cools rapidly, and is then ready for scrubbing again; so that the complete cycle of operations can be carried out within twenty-four hours, and therefore daily tests can be made.

According to the vapour contents of the gas being tested, from 100 to 200 c.c. of steam distillate are obtained. This is separated from the water, measured, and further examined by distillation. In most cases the estimation of benzene and toluene is the principal object. For this purpose Colman's method of fractionation and final distillation of mixtures with pure benzene, toluene, or xylene is followed.

Apart from the estimation of benzene and toluene, considerable interest attaches to the examination of the lower and higher fractions. Even one day's product yields a fair amount of material for the closer examination of the extract from the gas, and a week's supply will suffice for quite considerable research.

It should be remembered that the term "benzol" in this connection refers to a mixture of a number of hydrocarbons and sulphur compounds, and may include paraffins, di-olefines, and naphthalene. While at the moment the production of pure benzene and toluene is in the focus of interest, on account of the supply of raw materials for explosives and dyestuffs, the identification and quantitative relation of the other components of the mixture of vapours in coal gas is of the highest importance.

The extraction of condensible hydrocarbons from coal gas has probably come to stay, and will form a valuable source of raw materials for chemicals and motor-fuel purposes. As long as the present policy of gas undertakings—of supplying a more or less considerable percentage of inert gases with their product—continues, this deadweight must be compensated by enriching the gas with some compounds of greater molecular weight and of higher carbon: hydrogen ratio, and consequently higher calorific and illuminating value.

By a study of the compounds of this kind "naturally" present in the gas when leaving the retorts—or the superheater in the case of water gas—it will be found which of them are, economically, the most and which the least important. It will probably pay to extract the gas exhaustively, and re-incorporate with it the hydrocarbons having a lower value for other purposes; or else replace the extract or part of it by cheaper-grade petroleum distillates or cracked spirits.

However, signs are not wanting which point to the possibility of obtaining high makes of gas from coal without the necessity of dilution with nitrogen or carbon dioxide, in the not far distant future. If this comes to pass, it will be possible to extract all condensible compounds from the gas and still supply a commodity which in calorific value is far superior to that of the present day. But even now the detailed examination of the condensible hydrocarbons, beyond their customary inclusion in "C_nH_m" or "illuminants," of which they form the smaller portion, is essential.

It should be realized that the value of coal gas as a commodity depends in the first instance on its chemical composition. The expression of the aggregate of its constituents and their properties, merely by a composite physical value such as the heating or illuminating power, may be convenient and necessary for the business relations of gas-works with their consumers. But, for the study of the mechanism of carbonization and after-treatment of the gas and the wider aspects of the fuel problem, a more extensive application of analysis to coal gas, and particularly to its smaller but not less important constituents, is highly necessary.

It is hoped that this method will be found useful in this connection. In the control of benzol extraction plants it has been found capable of discriminating between the hydrocarbons present before and after scrubbing. As is only to be expected, it has been found that a large proportion of the naphtha scrubbed out from the gas consists of higher fractions which are of less immediate importance than benzene and toluene, which are frequently allowed to go forward with the gas. The daily control of the extracting efficiency and a closer study of oils and solutions (benzolized oils) at the temperatures concerned, is highly desirable.

It should be added that conversely the method is adaptable for the comparative testing of various oils against gases carrying known percentages of vapours, both as regards their absorbing capacities and their behaviour on steam distillation.

We are asked to intimate that the Blackburn Corporation Gas Sub-Committee have decided not to advertise the appointment of Engineer and General Manager, rendered vacant by the death of Mr. A. Morton Fyffe.

The Audley Lodge, No. 1896, at its installation meeting held in the Newport (Salop) Town Hall on Tuesday last, installed Bro. R. J. Milbourne, of Lilleshall Old Hall, in the chair as Worshipful Master for the ensuing year. There was a large and distinguished company of brethren connected with the gas industry present at the ceremony and banquet.

The late Mr. Bryan Donkin left to the Institution of Mechanical Engineers a legacy the income from which is to be devoted to grants in aid of original research in the science and practice of mechanical engineering. Mr. A. H. Barker, the recipient of a grant from the fund in February, has procured the apparatus for his research "to investigate a new method of determining the radiant temperature and air temperature in a room." The experiments are being conducted at University College; and the results will be embodied in a paper to be submitted to the Institution. The next award will be made in February, 1919.

NEW METHODS OF MEASURING GAS UNDER VARYING CONDITIONS OF TEMPERATURE AND PRESSURE.

[A Joint Paper by C. M. Walter, B.Sc., and R. G. Marsh, read before the Midland Junior Gas Association, Feb. 15.]

MR. WALTER COMMENCED.

The measurement of gas under varying conditions of temperature and pressure has been a subject of increasing importance, especially since the recent developments in connection with the distribution and application of gas under working pressures considerably higher than those which have been employed in the past. As is well known at the present time, the pressure at which gas is supplied for manufacturing and other purposes is no longer confined to the ordinary town pressures of 2 to 4 inches of water. Pressures ranging up to 15 lbs. per sq. in. are commonly met with, both in distributory systems and also in complete works installations, where, in many cases, this pressure is maintained right up to the point of combustion.

In accordance with the laws governing the specific volume of a gas under varying conditions of pressure, it is known that a given volume of gas under standard conditions of pressure and temperature—*i.e.*, 30 in. barometer and 60° Fahr.—will occupy half its former volume when subjected to an additional pressure of 30 in. mercury at the same temperature. Furthermore, it is known that a given volume of gas will expand 1-461th part of its volume for every increase in its temperature of 1° Fahr. under the same pressure conditions.

When, therefore, gas is supplied at pressures considerably in excess of ordinary town pressures, it becomes necessary to introduce some form of correcting device in the mechanism of the meter itself, whereby the amount of gas registered by the meter is representative of the true volume of gas consumed, measured under standard conditions, irrespective of the conditions under which the gas is supplied.

When it is practicable to supply gas at some definite and constant known pressure, it is an easy matter to so arrange the gearing of the index that the meter will constantly multiply the actual volume dealt with, by a factor depending on the particular pressure employed; but owing to the impracticability of maintaining a supply at an absolutely constant pressure, and, further, as errors of registration due to variations of pressure are more serious in the case of high initial pressures, a meter capable of automatically correcting its registration over a given range of pressures became necessary.

It was realized at the outset that the corrections desired could be effected by two distinct methods:

1.—By varying the capacity of the measuring drum inversely as the absolute pressure of the gas to be measured.

2.—By keeping the drum capacity constant and correcting the registration by mechanism in the index itself.

The latter method had already been adopted by Messrs. Parkinson and W. & B. Cowan in their high-pressure meters.

In pursuance of the first-mentioned method, it was very soon realized that to alter the capacity of the measuring drum by varying the amount of water in the measuring chamber presented so

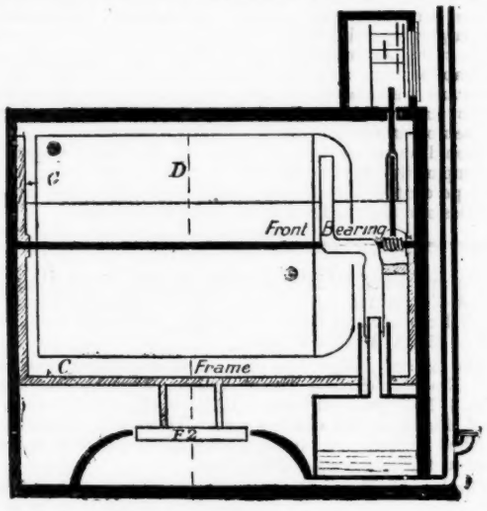


Fig. 1.

many difficulties as to be quite impracticable; but, at the same time, by devising some means of raising or lowering the measuring drum itself in the water, which would effect the same result, the latter principle became capable of employment with little complication. The method originally employed was as follows.

The drum D [see fig. 1] was mounted on its shaft in a cradle C; the whole being capable of vertical motion on suitable guides at each end. A large hermetically sealed air chamber to act as a float was fixed on the under side of the carrriage, supporting the major part of the weight of the moving system, but not in itself sufficient to support the whole weight. A second float F^2 attached to an extension of the cradle on the underside, was supported on mercury in a mercury reservoir; this, together with the first float, supporting the complete moving system. The mercury reservoir communicated with an outside vertical tube of even bore, which, together with the mercury reservoir, forms the two limbs of a U tube; the vertical tube being open to the atmosphere, while the mercury chamber is subjected to the pressure obtaining within the meter, *plus* the head of water between the surface of the mercury and the water-line.

The effect of an increase of pressure in the meter is that some mercury is expelled from the mercury reservoir to the expansion tube, thus lowering the level of the mercury in the reservoir, in consequence of which the drum is lowered, and its measuring capacity per revolution decreased. The sides of the mercury reservoir were to be so shaped that, for a given increase in pressure of the gas to be measured, the movement of the drum was such that its measuring capacity was reduced in exactly the same ratio as is the volume of gas reduced by its increased pressure. In other words, for a consumption of (say) 20 cubic feet per hour, the speed of revolution of the drum was constant, whether the pressure be 20-10ths water gauge or 15 lbs. per sq. in.

This plan necessitated certain modifications in the arrangement of the spout and upshaft, to allow of the free movement of the drum itself. In the arrangement shown, the spout is mercury sealed, and an extending joint fitted to the upshaft to the index-train. The drum was thus intended to float on the mercury, and alter its position in regard to the water-line in phase with the changing pressure.

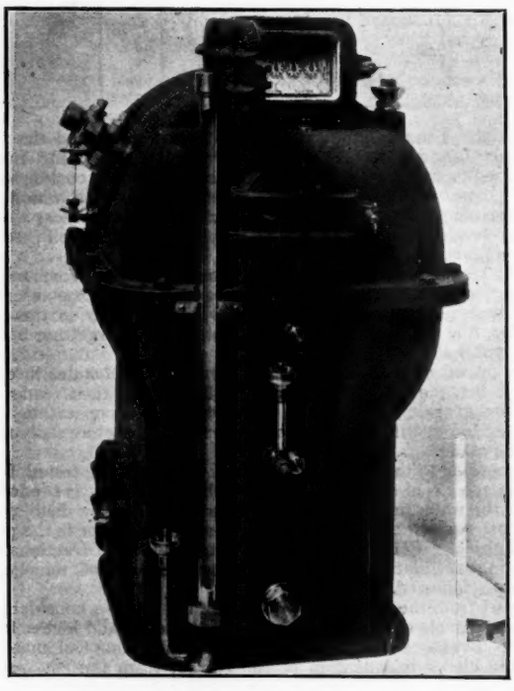


Fig. 2.

An actual meter has been constructed on the above lines, as illustrated in fig. 2, and has proved the accuracy of the principle on which it was designed. A great deal of valuable information has been obtained from the various experimental investigations connected with this meter. It was found advisable, from a practical point of view, to interchange the limbs of the U-tube, making the internal mercury chamber of large uniform cross section—that is of cylindrical form—which admits of a larger float being employed, thus increasing the responsiveness to slight variations of pressure. The outside expansion chamber in this case was constructed in the form of a chamber of uniform width, but of gradually decreasing cross section, in elevation not unlike an Eiffel tower. Fig. 3 shows a cross section of the meter, and fig. 4 an elevation of the expansion chamber. Fig. 3 indicates the general method of mounting the drum on its carriage, and the carriage rollers running on the four guides; the air float being marked X and the mercury float Y. A modified form of spoon compensator is shown, and also the mercury seal of the moving spout, and waste-water box, &c.

Lengthy tests, extending over six months, were conducted, during which period the meter was almost continuously registering under varying conditions of pressure; and careful records were kept of its performance. The method of checking the readings consisted of connecting the meter to a high-pressure supply con-

trolled by a governor, which afforded means of varying the pressure, and registering the gas after reducing to ordinary pressure through a test meter. The results of this investigation demonstrated that, though during certain periods the registration was accurate within the limits allowable, nevertheless at other times variations in the registration took place which could only be attributable to the sluggish movement of the carriage with small variations in the working pressures. This was afterwards confirmed by a careful examination of the various working parts.

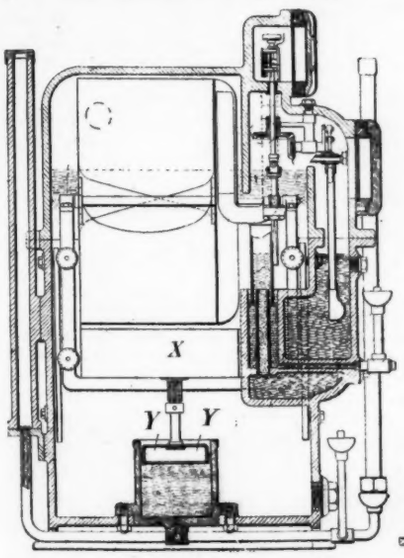


Fig. 3.

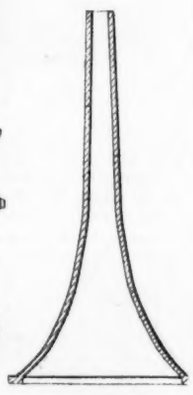


Fig. 4.

I would mention at this point that the principle of varying the capacity of the measuring drum by raising and lowering it in the water, was suggested in the first place by Mr. Marsh, and was the subject of an early patent—No. 12,500 of 1912—covering this principle. Further, the whole of the early investigations made in connection with the meter described were carried out by him, and proved conclusively that, where exact corrections were required, this principle would be undoubtedly the most suitable of all methods; and, as will be mentioned later, the principle is intended to be used in connection with test meters and apparatus in connection with calorimeter work, owing to the extreme accuracy obtainable, and also owing to the fact that corrections are made continuously even over fractional movements of the drum itself, instead of averaging over a given number of revolutions, as is the case with other apparatus designed for this purpose.

MR. MARSH CONTINUED.

At this point of the tests, Mr. Walter, who had always taken a keen interest in the meter, and who had rendered much valuable assistance with the tests, put forward a suggestion in connection with the construction of the meter which has made all the difference between success and failure of the new principle; and since this time, he has been closely associated with me in the matter, and in the subsequent developments arising from it.

To obviate the trouble caused by the sluggish action referred to, and to eliminate as far as possible sticking friction in all moving parts, it was proposed that the moving cradle carrying the drum should be mounted on pivots at one end, so as to move up and down radially. The only other support consisted of the water and mercury floats—the whole arrangement constituting a three-point suspension system. Accordingly, a meter was designed, drawings of which are shown in figs. 5, 6, and 7.

It will be noticed that in this case the drum cradle is mounted on pivots N arranged to one side of the drum itself. The mercury-float chamber is situated outside the drum chamber, so that the displacement of mercury in it does not affect in any way the water-line in the measuring chamber. The float chamber P is curved to the arc through which the float moves; and the float itself is curved so as to displace an equal volume of mercury throughout the whole of its range—this ensuring that the carriage moves in phase with the mercury level. The water float taking the major portion of the weight of the drum and carriage is shown at *Z*. In this arrangement, it will be noticed that the spout is fixed, and does not move with the carriage. A special meter drum with a wide diameter opening in the hood is arranged for, so as to permit the drum to move throughout its range without fouling any part of the spout pipe, thus doing away with a mercury seal at this point. The spout is drained by a tail pipe to below the level of the water in the waste-water box.

At first, a little difficulty was experienced in designing a satisfactory system of transmitting the motion of the drum to the index train, owing to the impracticability of employing universal joints. But this trouble was entirely overcome by the arrangement shown, which consisted of a side shaft T driving on to a double-faced bevel wheel W, running on the same centre as the pivots carrying the carriage. Thus any radial movement of the carriage causes the small bevel G to carry with it the large bevel W, until equilibrium is established, when the drive is taken up in the usual way.

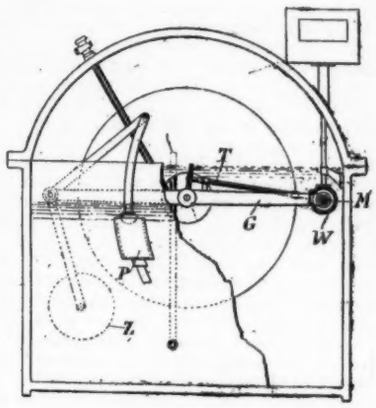


Fig. 5.

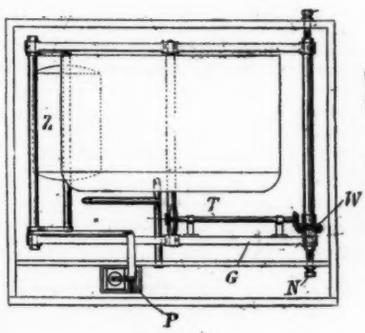


Fig. 6.

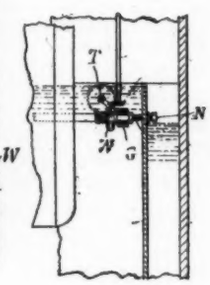


Fig. 7.

A meter was constructed on these lines at our own works, having a drum of a capacity of 1 c.ft. per revolution, and gave satisfactory results throughout the whole of its range from 20·10ths water to 12 lbs. per sq. in. The error shown by the test meter ranged between 1½ p.ct. fast and 2½ p.ct. slow. Results of the tests on this meter taken comprehensively show that, while it is capable of fulfilling all requirements from the point of view of the measurement of gas at varying pressures, at the same time such a meter would have the disadvantage of the size of the drum, and still more of the case, having to be considerably larger than that of a high-pressure meter with a fixed drum of the same capacity, depending for its correction on some form of index mechanism. In the first place, the effective measuring capacity of the drum is that when at its lowest position in the measuring chamber; and, secondly, sufficient space must be given in the case to allow of free movement of the whole of the moving system. At the same time, where the main object is accuracy of measurement, as in test meters, the advantages of the principle would undoubtedly outweigh the objections referred to, which would militate against its

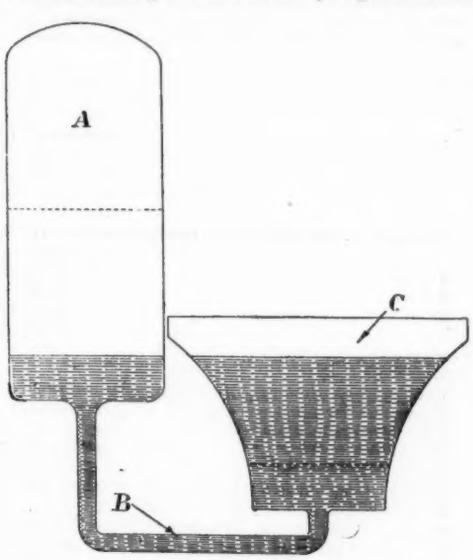


Fig. 8.

success as a commercial meter. As will be seen later, this principle may be usefully employed in connection with other gas-testing apparatus.

The next series of experiments conducted consisted in employing the curved mercury chamber for making the required correction in the index itself, in accordance with the second method of correction mentioned. The following is a description of the apparatus which was finally shown to give the best results. Referring to fig. 8, it will be seen that a U tube is employed having a closed chamber A as one limb, and an open chamber of varying section C as the other; the two being connected by a tube B. Under standard conditions of pressure—*i.e.*, 30 in. barometer—the mercury level is the same height in both limbs, while the space in the closed chamber A is filled preferably with an inert gas, also at atmospheric pressure. The whole arrangement is situated in the index box itself; and the open limb is subject to the pressure conditions of the gas to be measured.

It will thus be seen that, should the pressure rise, the level of the mercury is lowered, while that in the closed limb is raised, until an equilibrium is established, owing to the gas in the closed chamber being compressed until its pressure is equal to that of the gas to be measured, less the difference of mercury head in the two chambers. In the establishing of this equilibrium, a certain volume of mercury is displaced from the open chamber to the closed chamber; the changes of volume and movement of mercury being expressed in the following fundamental equation:

$$v_1^2\left(\frac{1}{A}\right) + v_1\left(\cdot 05 - p_1 - \frac{V}{A}\right) + V(p_1 - \cdot 05 - p_a) = 0$$

where V = volume of closed chamber above mercury level when under standard conditions of temperature and pressure.

v_1 = volume of mercury expelled for a rise in pressure of p_1 inches of mercury.

p_a = pressure equal to standard conditions to which gas is to be corrected.

p_1 = working pressure of gas to be measured.

A = area of cross section of closed chamber.

Changes of pressure will thus cause a flow of mercury from one chamber to the other, according to whether the pressure of the gas is increased or decreased. The sides of the open mercury chamber are shaped to a definite curve, so calculated, with regard to the dimensions of the closed chamber, as to give definite movements of the mercury level for certain changes of pressure in the gas itself. In the apparatus as in use, the relative dimensions of the two chambers are such as to give equal movements of the mercury for equal increments or decrements of pressure—that is, a movement of 1-10th inch for each pound per sq. in. variation in pressure, whether from 14 to 15 lbs. or 29 to 30 lbs. per sq. in. absolute pressure.

To make use of this movement, which is absolutely in phase with pressure changes, a float is employed on the mercury surface, which rises and falls with the movements of the mercury, and, by means of an operating rod attached to it, effects gear changes in the index mechanism to give the necessary correction to the registering train, or it may be used to operate a swinging drum direct, in order to effect registration corrections as has been previously described.

In the case of all correcting devices already mentioned, it will be noted that no attempt has been made to compensate for changes in volume due to variations in the temperature of the gas itself; and although no such correction is made in ordinary commercial low-pressure meters, nevertheless it is, of course, absolutely essential to correct for such variations in test meters and all gas-testing apparatus. In passing, it might be pointed out that the legal limits of accuracy being between 2 p.ct. fast and 3 p.ct. slow, these limits are easily exceeded by temperature changes alone, of which no account is taken when the meter is fixed on the district. A change of 4° Fahr. makes a difference of about 1 p.ct. in the true volume of the gas; and it is not unusual for the average temperature to vary as much as 20° from the standard temperature at which the meter was adjusted to register correctly (this being 60° Fahr.).

In this connection, it is important to note that the correcting apparatus referred to above is affected by temperature changes in the same way as by pressure changes, and corrects for variations both for temperature and pressure changes which may take place simultaneously. Thus its value for use in connection with all meters—not only high-pressure ones—can at once be realized, as it is adaptable in design for any ranges of temperature or pressure changes for which it is desired to make corrections.

Reverting to the mechanism by which the correction is made in the index itself, in the apparatus which is in use at present, this has been applied to an existing form of mechanism as patented by Messrs. Parkinson and W. & B. Cowan, which depends for its working on the employment of a gapped gear wheel, by means of which a greater or less number of teeth are made use of in the registering mechanism, according to the position of a sliding pinion engaging with it, which is controlled by means of the apparatus described directly by the conditions of the gas to be measured. Fig. 9 will show this clearly. In designing this mechanism, the authors have included in the specification a special form of fibre friction wheel, which distributes the correction more evenly over each revolution of the meter drum.

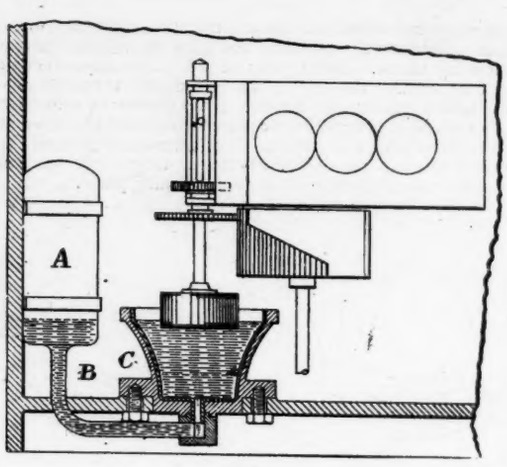


Fig. 9.

Fig. 10 is an illustration of a 5000 c. ft. per hour high-pressure meter, fitted with the apparatus above described, which is in every-day continuous use, and which on test gave results well within the limits of accuracy required.

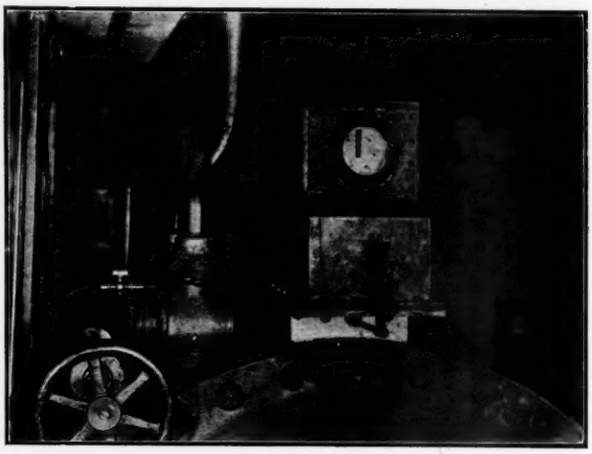


Fig. 10.

As there is a demand for test meters capable of automatically correcting both for temperature and pressure, a meter is now being designed embodying the two main principles which have been described—that is, the moving drum, which affords continuous correction over fractional movements of the drum, in combination with the mercurial compensator, which acts as the prime mover of the drum carriage, and which is affected by pressure and temperature simultaneously.

Further, in cases where it is necessary for the gas being measured to be both corrected to standard conditions and at the same time regulated to some predetermined rate of flow, as in the case of calorimeter work, by combining such a system with a pendulum-controlled drum, similar to that used by Beasley in his recording calorimeter, it is possible to fulfil all the conditions with regard to temperature, pressure, and density required for such determinations, which hitherto have necessitated individual correction, and made automatic registration impossible.

The authors hope, in the near future, to complete such an apparatus for use in connection with a special form of recording gas calorimeter, in which a true net value is obtainable, and in which ordinary thermometers are replaced by differential thermo-couples, making the whole of the determinations automatic and accurate.

DISCUSSION.

The PRESIDENT (Mr. G. C. Pearson, of Birmingham) having invited discussion on the paper,

Mr. E. W. SMITH (Birmingham) said that, having heard what the authors had to tell them, and seen the slides with which the descriptions were illustrated, they could not help being charmed with the ingenuity of the original device; and the work and care bestowed on adopting this combination to the mechanism subsequently were praiseworthy. There were a number of points of interest to chemists in regard to the application of this meter. As explained, it would be extremely useful in connection with test meters; but there were possibly a number of modifications that might have to be made to overcome certain difficulties. There were two types of test meter. First—and they were in by far the largest proportion—there was the type used on the works. These

had to be carried about from one point to another, and they must be light. They must be meters that could be shaken; and there must be no fear of spilling mercury. If any means could be adopted by which one could take precautions that mercury should not be spilled, one of the difficulties he foresaw would be overcome. Then most meters on the works were used at places where there were certain to be traces of sulphuretted hydrogen; and he would like to ask whether the mercury was in contact either with gases or with water which contained gas that was likely to affect the mercury and quickly corrode it, and so interfere with the measurement. He thought this might be overcome to a very large extent; but from the drawings he did not gather whether the mercury really was in contact with the gas. The other type of meter was used in connection with photometers and calorimeters—he meant the Junkers calorimeter, not the recording form. In such a case as this (speaking for himself) he would have to take the responsibility for the accuracy of the tests; and though personally he might feel perfectly satisfied that the meter had a very fine degree of accuracy, he did not think he would be prepared to accept any mechanism whatever as a check on the meter. It was so easy to make the corrections for these intermittent tests, that he did not think he would adopt the meter for this particular purpose. There were so many meters used, too, that possibly the price would weigh. An application of it which he thought was certain to prove a success was in conjunction with such instruments as the Beasley recorder. In this there was no correction whatever for barometer or temperature; and the readings might be out because of this by anything up to from 30 to 35 B.Th.U. If in the case of such an instrument it could be applied in the form of a governor, and not as a meter—and he had no doubt it could be so adopted—they would reduce the inaccuracies from possibly 30 to 35 B.Th.U. down to —he thought the range was about 3½ p.ct., which would only make a difference of about 16 or 17 B.Th.U., or half the former inaccuracy. This would be an advantage in those cases. What he had referred to was the range of inaccuracy of the instrument, not necessarily a constant inaccuracy. Then about the water-flow calorimeter, or any other type with differential thermo-couples. When the war started, the Birmingham Corporation had instruments on order from Germany, which were now in Hamburg waiting to be shipped—if they ever did get shipped—and if Mr. Walter was going on with his experiments, there was one point he would have to watch. The German instruments not only had a constant head which controlled the flow of water (an absolutely essential thing with such recorders), but they had a water-meter working in conjunction with the gas-meter, so that if the water flow varied, the gas rate would vary—these two remaining perfectly constant. Of course, it might be said that it was possible to have a constant head of water; but it was the experience with all water-flow calorimeters that the tubes in time blocked-up, and with this gradual process of blocking-up the rate of flow of the water would vary. Consequently, it was necessary to bring some device in for controlling the water flow in conjunction with the gas flow. One question that appealed to him in dealing with the paper was whether it would be necessary, in manufacturing these meters, to specially calibrate every meter, or whether they would be able to cast off the specially-shaped chambers, and be sure of them being always of the same dimensions for any particular size of meter. He could quite conceive that, with the castings, there might be differences in the dimensions of the chambers. Were they separate at the beginning, so that one could get at the inside without difficulty in order to machine them, or were they cast as shown in the illustration? Then he did not see quite how corrections for temperature were going to be brought in with this particular device. So long as the outer chamber with the index mechanism was the temperature of the gas, then the temperature would be correct. But they frequently found that the gas in the mains was hotter than where the meter was; and it was possible that the gas in the meter would be hotter than the atmosphere round the meter, and there would be a difference in temperature between the gas in the meter and the chamber which was outside the meter, unless the gas actually flowed through this chamber. At any rate, there might be 4° or 5° difference. He really put these questions so as to raise a discussion, and not with the idea of criticizing the paper, which he had enjoyed immensely. On behalf of the Association, he had great pleasure in proposing a hearty vote of thanks to the authors.

Mr. G. M. LEWIS (Birmingham) said the early type of meter was not altogether new to him. Mr. Marsh had shown him his first proposals in 1912, when he (the speaker) was intimately connected with the Meter Department. There had since been one or two things added which he would like to ask about. Was there any chance of the inner case becoming "tired" or leaking, and so upsetting the whole correction? In the second type of meter, it appeared to him that one mercury float coming over the side of the tank plate was rather a lop-sided arrangement. Would it not be better to have a float on either side of the drum? He did not quite understand which it was the authors recommended as the commercial type of meter. Was it the one with the rising drum, or the one with the correction in the index? It seemed to him that, for an ordinary meter for commercial purposes, the index arrangement would be preferable, owing to the much reduced cost, and because he thought with the other type there would be some friction on the gear-train of the index. Those who had been connected with meters were always particularly attracted by the simplicity of the wet meter, which had, with very little alteration, stood for close upon a hundred years; and it was very correct, provided the water-line was kept accurate. The ordinary wet meters were being made by workmen who were mostly tinmen, and very capable at their business; but it seemed to him that the kind of meter now described came more within the range of scientific apparatus. They could not judge exactly without examining the meter at work or made up. But from the sketches it appeared rather complicated; and he thought the cost of repairs would be somewhat high, compared with what they had been used to. Could the level of the mercury in the index chamber be ascertained without pulling the thing to pieces? He had no doubt many cases would arise in which this level might be altered; and he wondered, therefore, whether there was any gauge showing outside the meter by which one could ascertain the level of the mercury without displacing anything. He had always thought that they must not lose sight of the fact that the only way to secure accurate correction was by reducing the capacity of the drum; and he still believed this to be the correct way to measure gas, though the correction on the index gearing now explained was very ingenious, and no doubt came much nearer to accuracy than had been done in this direction before.

Mr. R. J. ROGERS (Birmingham) remarked that Mr. Smith had referred to the use of test meters, particularly on the works; but the possibilities of the apparatus which had just been explained appealed to him (the speaker) more particularly in its application to commercial meters. There was no doubt that a certain amount of curtailmennt took place in the development of the use of high-pressure gas, by reason of there not being an efficient measurer of it. They were all familiar with the various systems which had been in operation since high-pressure gas came along. Mr. Marsh had referred to registering at constant pressure with a constant correction in the gearing of the index, and that this they could not consider satisfactory, owing to the difficulty in maintaining a level pressure. Then there was the other method explained, in connection with the alteration of the gear mechanism; and he thought there was no reason to doubt that the application of the mercury chambers as shown in fig. 9 was a very great improvement on the original idea. Mr. Smith's point in regard to the sealing-in of the mercury he did not think would form any serious objection to the use of the system in commercial meters, because such meters were fixed rigid, and required very little alteration when once fitted. But, of course, it would be an improvement if the authors could devise some means to prevent any of the mercury spilling over. They were all aware that the Sales of Gas Acts were not up to date, as they should be. In regard to other commodities—such as food —that people purchased, there were very accurate methods of measurement or weighing, which were governed by the Weights and Measures Act; but in connection with the sale of gas, they had a product that was not stable. It was subject to very great variation; and up to the present time there had been no meter which had made an attempt to compensate for the varying conditions under which the gas was being supplied. This was an important point, when they come to consider the large consumptions that had to be measured by meters. If an improvement could be made of 1 or 2 p.ct. in the registration, due perhaps to compensation for the atmospheric pressure or temperature, it would be worth the earnest support of all of them. The paper they had just listened to would, in this direction, raise many thoughts in the minds of gas engineers generally. He hoped that something would develop on these lines which they might adopt in a commercial manner to the measurement, not only of high-pressure gas, but also of low-pressure gas.

Mr. W. LYCETT (Birmingham) asked what back-pressure (if any) the meter threw in working, and whether, on suddenly putting on several muffles or large annealing ovens, there would not be tremendous fluctuation of the drum. If so, would not this interfere somewhat with the registration? This would apply, of course, to figs. 8 and 9 as well.

Mr. J. TURNBULL (Birmingham) said that, as Superintendent of the Meter Repair Shops, he had had a very intimate and interesting experience with at least two types of the meter—the original one with the mercury float in the water, and the other one with the float outside the water altogether. With regard to the point raised by a previous speaker in connection with the second type of meter, where the float was outside, this undoubtedly did look a little lop-sided; but from his own experience he could assure them that the gearing, and the whole weight of the thing and its equilibrium, were so well arranged that this was not a serious drawback to it. The idea of correcting the capacity of the mete by moving the drum was a splendid one, inasmuch as it was bound to be accurate so far as the measuring capacity was concerned. As to the second type, which he regarded as much the better of the two—*i.e.*, the one mounted in its own frame, where the entire frame and drum were hung upon a pivot—the friction here would be very little indeed, much less than in any other wet meter made to-day. The smaller surface exposed reduced the friction to a minimum.

The PRESIDENT, in seconding the vote of thanks, congratulated the authors on the apparatus described, which showed great inventiveness on their part. He had been particularly pleased to hear Mr. Turnbull's contribution to the discussion, because he was a practical meter maker, and his opinion was well worth having. High-pressure gas supply had assumed very big dimensions in Birmingham; and it was necessary to have accurate means of measuring it. What they wanted to do now, no doubt,

was to regard this meter primarily for measuring high-pressure gas, which was what it was designed for. He was a little disappointed to find no actual figures were given as to what the authors had found to be the accuracy of their invention—whether it was within the limits allowed. It would have been interesting if they could have been told what was the accuracy of the aneroid type of meter, and how it compared with this new one designed by the authors. The consumption of gas for furnaces would go up by leaps and bounds; but whether or not it was necessary to utilize high-pressure gas for this work was a very doubtful point. Fine results were being obtained with gas at low pressure; and if it was possible to utilize low pressure for a large proportion of the furnace work, it would be greatly to the advantage of the department and of the consumers to adopt it. With high-pressure gas, there was necessarily a good deal of loss of calorific value from deposition of the oils in compressing. As regarded the application of the meter to laboratory testing purposes, he did not think it would be of much help; but it would no doubt have a big future for use with recording calorimeters. There was a distinct need for an accurate regulator meter with this type of apparatus.

Mr. WALTER, after acknowledging the vote of thanks (which was heartily accorded), said, as regarded the effect of sulphuretted hydrogen on the meter parts, he thought if this were present in relatively large quantities in the gas metered, it would undoubtedly be a serious matter; but on a six months' test they had carried out, on the meter as in fig. 2, the effect of the gas on the mercury was quite negligible. Only a slight scum was observed—nothing which could in any way affect the registration. In reference to the effect of variation in temperature of the gas and the influence of higher or lower outside temperature, the whole of the working parts were subjected to the pressure conditions of the gas to be measured, and would be in practically uniform condition throughout as far as temperature was concerned; while the velocity of the gas passing through the meter would be sufficiently low to ensure that the correcting chamber D would assume the same temperature as the gas itself. The cylinder, as in fig. 8, was of cast iron, and, owing to its conductivity, should respond readily to any change in temperature. Regarding the inert gas in the sealed chamber of the correcting device, the whole accuracy of the meter depended on maintaining this gas without loss, as any escape would be fatal in this respect. It was proposed to line the cast-iron cylinder with vitreous enamel, to obviate the slightest possibility of any loss of gas from the chamber. There was, of course, no question of this gas becoming "tired," as in the case of a metallic aneroid. It was proposed, in the latest form of the meter, to have pure nitrogen in the inert gas chamber. The manner in which the meter device corrected for temperature would be seen, if they considered that change of temperature was equivalent to a definite pressure variation. Let it be assumed, as an illustration, the absolute pressure of the gas to be doubled. The result would be that the volume of the gas in the closed chamber would be halved, or nearly so, except for the difference in the head of mercury. The meter would then register double the volume actually passing through it, which would be correct, as the gas measured would occupy half its former volume. Now assume the absolute temperature to be doubled. This would have the effect of doubling the volume of the gas in the enclosed chamber, and bringing the float back to its normal position. The gas being measured would be expanded in the same ratio; and the registration of the meter would therefore still be accurate. This extreme case furnished the simplest manner by which to illustrate the action of the correcting device for temperature, and the principle held good for any variations up or down the scale. As to the use of the meter in connection with recording calorimeters, they must have a gas-regulator which would enable a recorder to give "true" net values, correct to within ½ p.ct.; and it applied specially to instruments of this kind on works. He thought the principle would be found very useful for this class of apparatus. The President had mentioned high-pressure gas, as opposed to low-pressure gas and air-blast, for metal melting. For cases where the number of melts was fixed, the high-pressure gas system had decided advantages, taking into account any slight loss in calorific value due to the compression of the gas. They were at present developing a system with gas at 5 lbs. pressure and air-blast at 100 inches water-gauge, which should be capable of meeting any requirements where high speeds of melting and extremely high temperatures were necessary.

Mr. MARSH, in reference to the portability of the meter on works, said the meter, as in fig. 8, could be arranged so that no loss of mercury occurred if the meter had to be moved. A needle valve was fitted in the passage B, and could be operated from outside the meter. After the meter was adjusted, this valve was closed-down, and the mercury in the two chambers thus isolated. The mercury in C was then drained off into a bottle; filled in again when the meter was set up in the new position; and then the needle valve was re-opened. This ensured that no loss of mercury took place, and also precluded possibility of loss of gas from the chamber A. The chambers A and C were accurately machined, and the dimensions thus standardized. It was therefore not necessary to calibrate each meter separately. The chamber castings were standard for a variety of sizes of meters, and equally adaptable to wet or dry meters. He thought the index type of meter would be the one most utilized commercially, though the drum type would be more useful for certain classes of test meters. As regarded back-pressure thrown by the meter, the greatest amount they had observed, due to the submersion of the drum and the disturbance of the water-line owing to the drum being so deeply submerged, was 1 inch water-gauge; and this difficulty had been overcome by fitting a specially designed drum with six chambers. In the newer type of the meter, with the special drum, it was found not necessary for the spout to move; and the mercury seal at this point had therefore been discarded. A sudden call on the meter, due to lighting-up muffles, &c., would not interfere with its action any more than in the case of an ordinary low-pressure meter. Tests on the meter were conducted progressively with gas pressures ranging from 5-10ths of an inch water-gauge to 12 lbs. per sq. in.; and the accuracy of the results varied between the figures given—namely, from 1·5 p.ct. fast to 2·5 p.ct. slow. Beyond this, they had not thought it necessary to give lengthy details. As regarded the lop-sided appearance of the arrangement shown in figs. 5 and 6, this particular meter was "home made," with the materials most readily to hand; and the arrangement could easily be improved in subsequent design.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Yorkshire Junior Gas Association was held on Saturday afternoon, at the Darley Street show-rooms of the Bradford Corporation Gas Department—the President (Mr. J. Lister Cooper) occupying the chair. There was a good attendance of members.

The meeting was (as already announced would be the case) of a private nature, devoted to the discussion of questions from a set of sixteen, prepared beforehand, on matters of importance to the profession at the moment—see *ante*, p. 297. The gathering was not open to the representatives of the Press, in order that the younger end of the membership might be given an opportunity of cultivating boldness of speech in public. It is intended to hold one or two meetings of this character during each session, which will be devoted to the consideration of questions submitted to the Secretary by any members who are in doubt on technical or other points. On Saturday, the discussion was very animated—occupying over two hours—in the consideration of only seven of the sixteen questions on the list. The questions discussed were numbers 1, 2, 4, 5, 7, 8, and 15 on the list. Among those taking a leading part were Messrs. Charles Roper, J. W. Roper, J. M'Lusky, J. E. Holliday, E. L. Oughton, S. H. Packer, C. D. Cawthra, W. Walker Atley, E. Sellers, W. H. Riley, and J. Denham.

The next meeting of the Association will, it is expected, be a visit to the Yeadon Gas-Works, under the charge of the President (Mr. Cooper), on Saturday, March 17.

Gas Undertakings and Unbadged Men.

The National Gas Council have issued the following important notice to gas undertakings that have no badged men. They are informed that where gas undertakings have not at any period had badges on behalf of any of their employees, the Ministry of Munitions' Substitution Scheme cannot be applied; and in these cases a strong protest should be made to Tribunals which seek to take necessary men away from the industry. The grounds of appeal will be strengthened by reference to the extracts from the "List of Certified Occupations" which were published in the "JOURNAL" last week, p. 293.

Calorific Standard Orders and Applications.—An application has been made by the Sittingbourne District Gas Company to the Board of Trade for an Order specifying a calorific standard of 500 B.Th.U. The Board have made Orders under the Act for the British Gaslight Company, Limited (Norwich undertaking), the Leamington Priors Gas Company, and the Sevenoaks Gas Company.

Munitions Petroleum Supplies Branch.—The Minister of Munitions has established a branch of the Ministry to be known as the Munitions Petroleum Supplies Branch, which will deal with mineral oils, under the directorship of Mr. E. Houghton Fry. Sir Boverton Redwood, who will have charge of the research section, including the development of the British sources of supply, has been Hon. Adviser on Petroleum to the Government for many years; and he has stipulated that he is to receive no payment for his services in his new position.

Brown Coal in Victoria.—Mr. G. T. Milne (H.M. Trade Commissioner in Australia) has, states the "Board of Trade Journal," forwarded particulars of brown coal deposits at Morwell, and of the steps being taken by the State Mines Department to ascertain the merits and commercial possibilities of the coal which is being obtained there. The Department have made preparations for exhaustive preliminary tests; and this work is being carried out on a commercial scale. It is hoped to show that crushed brown coal is suitable for boilers and furnaces of the open-hearth type for steel-making. Gas-making tests which have been made are stated to be encouraging. The coal has also been used for briquettes; and it is reported that in this form it can compete with black coal for steam-raising.

NEW BUSINESS.

The present is not an opportune time for the discussion of questions relating to extensions of business, yet it is well that the subject should not drop entirely out of sight. Therefore some information collected by the "Gas Age" [New York] is not without interest.

Although the figures indicating the amount spent in getting new business cannot be determined with the accuracy of a balance at the bank, and there is no uniform method of recording the exact sums so expended, statistics collected from eleven States, representing more than half of the total production in the United States, deserve some attention. The census returns show that, in 1914, 1284 undertakings produced gas and residuals to the value of $220,237,781; and of this sum, $117,265,703 are represented in the returns.

The definitions of the item appear to be somewhat indefinite. Indiana includes "salaries, commissions, supplies, and expenses;" New Jersey, "new business expenses and promotion;" California, "commercial expenses;" New York (first district), "promotion, office expenses, advertising, and canvassing;" Oregon and Connecticut, "new business expenses." The average shown by eleven states is 2·8 p.ct. of the value of the product. Cutting out California (7·5) and Maryland (6·7), however, the average is just under 2 p.ct.; and this expenditure is practically confined to the larger undertakings. If these were removed from the table, the average would be more like 1 p.ct.

No statistics are available as to the expenditure of British gas undertakings in advertising and similar effort; but it may safely be put at something very much less than the 1 p.ct. referred to. In this instance, also, the expenditure is principally confined to the larger undertakings. The subscription to the British Commercial Gas Association represents a very small fraction of 1 p.ct.

AN IMPROVED MAKE OF SLIDE-VALVE.

Mr. D. E. Keppelmann, the General Superintendent of Distribution of the Pacific Gas and Electric Company, San Francisco, has described in the "American Gas Engineering Journal" a new design of slide-valve, suitable for almost any purpose, and claims that it is a very successful remedy for the difficulties in working common to the ordinary makes of slide-valves, which depend for tightness upon one or two discs riding in a groove between two seatings. Valves are, he says, carefully tested by the makers, and sent out in sound condition, but cannot be relied upon to retain tightness, even over a short period of use; and serious inconvenience and risks are thus occasioned, due to accumulation of foreign matter in the groove hindering or preventing the complete closing of the port, or to scoring of the working faces by high pressure.

In the new design, he has eliminated the grooved trap, and rendered the accumulation of foreign matter on the working parts of the slide or seatings a physical impossibility. The opening and closing member consists of a solid four-sided wedge, constantly riding on wedge-shaped seatings located on the sides of the casing; and when open there is a clear space right through, with no restriction of any kind for the accumulation of foreign matter, so that there cannot be hindrance or obstruction to the complete closing at any time. If foreign matter accumulates against the slide while closed, the obstruction is detached by the lifting of the wedge in opening, and carried forward by the current.

As compared with the old pattern, the new design is smaller in size, and the difference is accentuated as the diameter of the openings increases. It is 20 p.ct. less in first cost; and the self-cleaning and non-scoring working faces eliminate maintenance expenses or removal for cleaning, ensure efficiency and a long working life, and avoid the dangers due to leakage through when a valve is supposed to be closed. It can be readily modified to give a quick-moving action.

PROTECTION OF STEEL OR WROUGHT-IRON PIPES.

In view of the uncertainty prevalent as to the effectiveness of protective coatings, the most suitable mixture, and mode of procedure, Mr. Walter V. Turner has collected information from several leading gas undertakings, and communicated it to the "Gas Record." Some claim that its use abundantly justifies the small extra cost; others either say that it is useless or that they do not need it; while a third class use it only in specially bad or corrosive soils. No doubt the quality of the soil is an important factor. Consequently, each company has its own methods and ideas; and it is not possible to say that any one mixture is the best for all purposes. The object is to prevent corrosion due either to the soil or to electrolysis; but the general opinion is that while electrolitic action can be retarded, it cannot be wholly prevented, and, in some circumstances, such as abrasion at one or two places, the destruction of the pipe may be accelerated by concentrating the electrolysis at the unprotected spot.

Much emphasis is placed upon the importance of a strong cohesive union between the material and the pipe, the pores of which should be permeated to the complete displacement of the air; and the pipe must, as a preliminary, be heated to a sufficient extent to render it perfectly dry. While hot, it should be dipped in a mixture heated to about the same temperature, and allowed to soak for a sufficient time to fill all the pores. Opinions differed as to the desirability of using wrapping, which was an annoyance when applying tools, and but a very partial protection against accidental abrasion. Great care was required in the handling and stacking of coated pipe; special hook plates being used for long lengths, while short pipes could be shifted by means of the hard wood end caps with handles provided for closing the ends of the pipe when dipping. Threaded ends exposed to sunshine or rain should be protected by canvas wrapping. The pipes should stand in a covered shed for several weeks, and be perfectly "set" before use. Another difficulty was the elbows, bends, and other specials, as unless the coating is entire throughout it is worse than useless. This was met by the use of galvanized metal, or by coating the fittings with hot mixture after fixing. The use of galvanized pipe, or encasing in pitch contained in wood troughs of box or V section, was resorted to in exceptionally bad soils.

The exterior surface is made perfectly clean by the use of files, wire brushes, rubbing with dry ashes or oily waste, &c., after which 80 lbs. pressure steam may be blown through, to dry the interior of the pipe, and detect pin holes or such-like defects. The use of hot dry air is suggested as preferable to steam, which might leave traces of moisture behind it. The pipe is then dipped, the wrapping (if used) applied, and followed by a second "dip," lifted out and allowed to drain over the dipping trough, brushed free from excess of coating, and piled in layers between strips of sanded wood. "Dipping" is not universal; many engineers preferring to apply the coating by means of the brush.

Investigations prove that in good soil the coated pipes will last thirty years or more. Reference is made to a paper upon the same subject, submitted to the Illinois Gas Association in 1909 by Mr. R. A. Harper.

The protective mixtures mentioned in the paper are tar pitch (applied in two coatings, the first cold, the second hot), asphaltum (hot), and red lead; but tar as a basis takes the leading place. These are for the most part applied with the brush. Felt wrapping, covered with painted canvas, is used as a protection against cold in exposed places. The dipping mixtures are the "Cincinnati" and the "Hickenlooper"—the first prepared by taking the soft pitch obtained by boiling down 25 gallons of coal tar, cooling to 250° Fahr., and mixing in 5 lbs. of tallow and 1¼ lbs. of resin. In 7 gallons of "peerless thinners" 2¼ lbs. of crude rubber, finely shredded, is dissolved, and the solution added and thoroughly incorporated immediately before using. For the second, 20 gallons of boiling tar is mixed with 20 lbs. of finely powdered and freshly slaked lime, and further boiled down to a soft pitch; after a few minutes, add 4 lbs. of tallow and 1 lb. of powdered resin. Store in barrels, and when required for use, add 4 lbs. of crude rubber dissolved in 4 gallons, or sufficient turpentine to form a thick cream. The dipping temperature with this mixture is about 100° Fahr. The dissolving of the rubber is a slow process, occupying several weeks, and must be assisted by fine shredding in the first place, and frequent stirring.

The cost of the painting processes appears to be about ½ c. per foot run, that of the "Cincinnati" mixture, including muslin wrapping, from 1½ c. for ¾-in. to 6 c. for 4-in. pipe, and that of the "Hickenlooper" is stated to be 0·4 c. per foot run of 1¼-in pipe, including labour.

Utilization of Cyanogen.

The Citizens' Gas Company of New Jersey have, according to the "American Gas Engineering Journal," erected the first cyanogen plant in the country that is capable of carrying the process from extraction from the gas to the finished product. Mr. Forrest (the Manager of the Company), explained that, finding it possible to place a contract for as much sodium-ferrocyanide as they could produce during the ensuing twelve months, at a high price on account of the war, they decided to erect a plant that would turn out a finished product, saleable direct to the consumers. The product would be used in the manufacture of colours—a process having been developed in America by which it could be successfully applied as a substitute for potassium-ferrocyanide. The potassium element had always been supposed, by the German manufacturers, to be essential to the production of satisfactory blue colours; but when war broke out, the importation of dyes was cut off, and there was a very great increase in the prices of potash, so certain manufacturers began to experiment with the sodium compound. Their efforts were successful; and the result was the establishment of a new colour industry in the United States. It would be equally possible to produce the potash compound with the Company's new plant, at any time when commercial considerations rendered this course desirable. The plant had only been working for a few months; and some improvement on the present results was expected to be obtained with longer experience. But the net earnings had already repaid half the construction cost, and a handsome profit was assured before the expiration of the present contract.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

South Suburban Gas Company's Application under the Gas (Standard of Calorific Power) Act, 1916.

[We are asked by the General Manager's Department of the London and North-Western Railway Company to give publicity to the following communication arising out of the report last week, p. 308, of a Board of Trade inquiry under the Gas (Standard of Calorific Power) Act.]

SIR,—We wish to call your attention to the following inaccuracies which appear in your report of proceedings before the Board of Trade on the 6th inst. in connection with the above.

In regard to the evidence given by our technical expert, Mr. E. S. D. Moore, on behalf of the South-Eastern and Chatham Managing Committee, the following passage occurs on p. 309 of the current issue:

> "Taking an exact ratio between 475 B.Th.U. and 15-10ths, the pressure with 500 B.Th.U. should be 25-10ths; but as 20-10ths was granted in the Sheffield case, he would be content with that."

What was said, in so many words, was that, assuming the Board of Trade were correct in fixing 15-10ths as the minimum pressure for 500 B.Th.U. gas, as they have done in all their Orders under the Gas (Standard of Calorific Power) Act, then with 475 B.Th.U. gas an additional 5-10ths pressure should be prescribed—*i.e.*, the minimum should be 20-10ths. The Railway Companies have contended throughout that, with 500 B.Th.U. gas, the minimum pressure should be 20-10ths; and on this basis the minimum pressure should be 25-10ths with 475 B.Th.U. gas. No mention of the Sheffield case was made by the above witness in this connection; but it may be pointed out that 20-10ths minimum was secured to the Railway Companies by consent at the Board of Trade inquiry into the latter case.

With regard to the arrangement effected on the question of pressure, in the course of the proceedings under notice, in consequence of which no further evidence was called on behalf of the Railway Company, although only 15-10ths minimum pressure was offered on behalf of the Gas Company by their leading Counsel, Mr. Vesey Knox, in the course of his opening speech, he finally agreed to 20-10ths (not 15-10ths as stated in your report) being included in the Order if the calorific penalty point was fixed at 475 B.Th.U.

We trust you will kindly publish these corrections in your next issue, as the report, as it now stands, is somewhat misleading.

Euston Station, Feb. 15, 1917.

Benzol Recovery—Are Gas Undertakings doing their Share?

SIR,—On reading the "JOURNAL" this week I was astounded at the figures you gave of the number of gas undertakings that are at present oil-washing—only 80 out of 800, with a prospect of a further 70 in the future.

I had occasion to shut-down my plant this week; and, on advising the authorities of this, was informed that it was a serious matter to do so. Surely, if the position is so serious, and the production of benzol is needed to win the war, steps should be taken at once to bring those undertakings that are not at present oil-washing, or installing plant, into line with the few who are "doing their bit."

As the response to voluntary appeals has been so small, I think the time has arrived when compulsory measures should be brought to bear on the undertakings that are still ignoring this very important work. The war is not over yet; and victory can only come by everyone doing his bit. I am sorry to see so many in the gas industry lagging behind in this matter.

I sincerely hope your appeal will have good results, and that all undertakings will take up oil-washing at once and show that the industry is doing its share. By so doing, I am sure it will help to strengthen the position of all in the future.

J. H. DONALDSON, Engineer and Manager of the Sevenoaks Gas Company.

Sevenoaks, Feb. 16, 1917.

Colliery Owners' Profits.

SIR,—You have from time to time had something strong to say of coal owners and prices, &c.; but I think the enclosure, from the "Manchester Daily Dispatch" of Friday last, reporting a 35 p.ct. dividend for 1916, free of tax, rather knocks the bottom out of their profession of increased working costs, &c.

> **Fife Coal Co.**—Dividend of 25 per cent. on the ordinary shares, making a total distribution of 35 per cent., free of tax, for 1916.

Whitchurch, Salop, Feb. 12, 1917. J. F. TYNDALL.

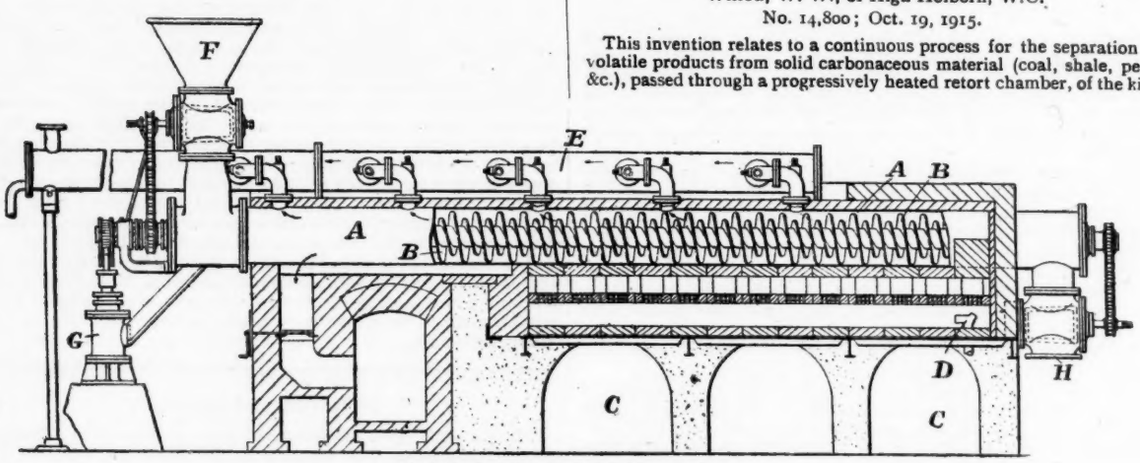
REGISTER OF PATENTS.

Separating Volatile Products from Solid Carbonaceous Material.

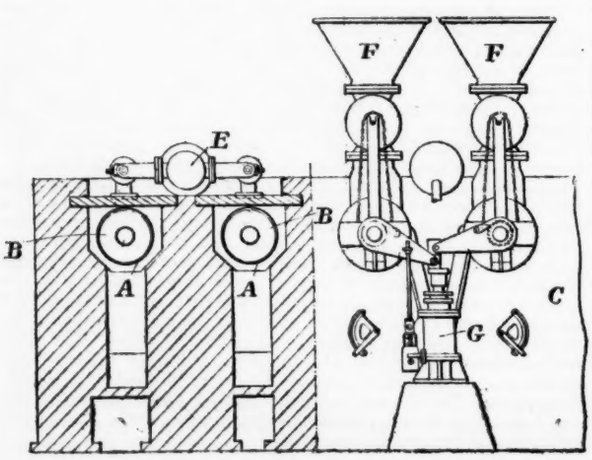
WHITE, W. W., of High Holborn, W.C.

No. 14,800; Oct. 19, 1915.

This invention relates to a continuous process for the separation of volatile products from solid carbonaceous material (coal, shale, peat, &c.), passed through a progressively heated retort chamber, of the kind



White's Continuous Carbonization Plant.



in which vapours produced at different temperatures are withdrawn immediately from the heated material into a separate vapour chamber; the arrangement "enabling the oils and other condensible substances to be gradually deposited in the chamber without the necessity of cooling the vapours to a low temperature."

A longitudinal section is given, with parts in side elevation, of a plant embodying this invention; also a part end elevation and part cross section. A are horizontal, or nearly horizontal, retort tubes receiving the carbonaceous material, carried along the tubes by screw conveyors B. C is the furnace in which the retorts are heated by the gas-jet D placed near the discharge end. E are the vapour condensing tubes or receivers above (and between) each pair of retort tubes, with which they communicate at different points along their length by connecting pipes—the tubes E having at their cool end gas and oil outlets.

The carbonaceous material to be distilled is fed to the retort tubes through hoppers F; each hopper having a rotary feeding valve operated by chain gearing from the shaft of the screw conveyor, which is rotated intermittently by hydraulic ram or motor G. At the coke discharge outlet H is a rotary discharge valve driven by the chain from the discharge end of the conveyor shaft, so that the inlet and discharge operations proceed steadily under the same control.

The retort tube is heated at a progressive temperature from the inlet end to a point situated beyond the last (or right hand) connecting pipe

leading to the condensing tube E. It is said to be found that this progressive heating can be effected by the single jet D supplied with gas (it may be that produced in the apparatus itself) and preferably with hot air heated by the waste heat from the furnace. The hot gases from the furnace chamber containing the jet pass up through the perforated fire-brick floor, thence into the space surrounding the retort tube, and, after flowing along this towards the inlet end, escape into the main flue. As the temperature of the gases is steadily falling towards the flue, the tube A is only moderately heated near the inlet end—the temperature progressively increasing from this end.

The condensing tubes E are outside the furnace proper, but so situated that unduly rapid cooling of the vapours is avoided. The tubes also extend for some distance beyond the inlet end of the retorts—the extended portion, clear of the furnace casing, serving for the final condensation of the liquefiable part of the vapours.

The operation of the apparatus is as follows: The coal is fed at regular intervals into the inlet end of the retort tube from the hopper F; the feeding valve preventing gases from the retort escaping through the hopper. The screw conveyor B, driven by small regular intermittent movements, takes the material from the inlet end gradually through all the zones of increasing temperature; the volatile constituents being progressively driven off until the remaining solid material discharged at H contains only a small proportion of the volatile ingredients. The proportion depends upon the maximum temperature attained—say, about 600° C.—and the rate at which the material is passed through the retort. As the material passes through the low-temperature zone of the retort, water and any very volatile ingredients which may be present are driven off, escaping into the chamber E at each side through the first of the connecting pipes. As the material travels into hotter zones, volatile ingredients having higher temperatures of vaporization are driven off, and are promptly removed, close to their place of origin, by the adjacent pipes into the relatively cool chamber E. The vapours therefore remain only for a short time in the hot retort tube, and are removed before any appreciable "cracking" can take place.

Gas-Fired Crucible Furnaces.

KEITH, J. & G., of Farringdon Avenue, E.C.

No. 17,902; Dec. 22, 1915. No. 8793; June 22, 1916.

In the use of crucible furnaces fired from below, according to the practice at present most widely adopted, it is found, the patentees remark, that the gas-flame has a very serious destructive action on the material of which the crucible is composed—making it deteriorate rapidly in consequence of the flaking-off of large pieces from the lower end on which the flame first impinges.

In a crucible furnace according to their present invention, provision is made for introducing the mixture tangentially, and with a slight upward inclination, into a recess formed in the cover of the furnace. The cover being composed of highly refractory material, the products of combustion are deflected downwardly by it, and led downwards between the crucible and the interior wall of the furnace—which wall preferably conforms to the contour of the crucible while being spaced therefrom sufficiently to leave a practicable working space for the downward passage of the hot products.

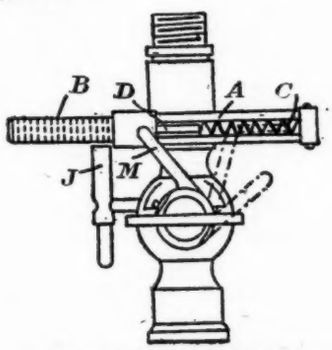
The importance of this heating from the top will be appreciated, the inventors say, if it be kept in view that, whereas when the contents of the crucible are heated from below in the usual manner the metal in the bottom of the crucible is melted and becomes thoroughly hot long before the metal floating on the top does, while the addition of solid metal to the molten, or partially molten, contents of the crucible has a chilling effect, and even tends to cause solidification of already molten metal, when the contents of the crucible are heated from above the result is "to improve the circulation—the metal flowing to the bottom as it becomes molten and heavier."

Pyrophoric Gas Lighters.—No. 102,139.

ROSEMBERG, J. M. M., of Paris, and BROSSE, P. E. M. of Neuilly-sur-Seine, France.

No. 13,244; Sept. 18, 1916.

The patentees' proposal is for the friction element of a pyrophoric igniter to be automatically moved in a rectilinear path by means connected to the gas-cock.



Rosemberg's Pyrophoric Gas-Lighter.

In one form, the friction element comprises a rod B having a file-like flat surface, and slidably mounted in a tube A—the pyrophoric alloy being arranged in a tube at right angles. On opening the gas-cock, a flexible arm M on the cock, by engaging a projection D on the rod B, forces the rod against a spring C until the arm passes below the projection. The spring then forces the rod backwards, thereby igniting the pilot-jet J. The passage to the pilot-jet is opened during the first part of the opening movement of the cock, and is closed during its completion. An inclined surface on the projection D allows the arm to spring over the projection when the cock is closed.

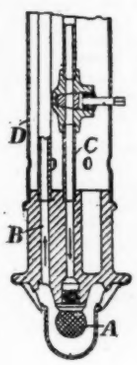
Zinc Sulphide and Ammonium Sulphate.—101,978.

AARTS, C. J. G., of Delft, Holland.

No. 15,260; Oct. 26, 1916.

The patentee proposes to completely convert zinc sulphide—including zinc blende—waste products containing zinc sulphide, or precipitated zinc sulphide into sulphate by heating with oxygen, or gases containing oxygen, under pressure.

The invention is described with reference to a process for purifying gas by washing with a solution of zinc sulphate so as to produce zinc sulphide and ammonium sulphate, in which the zinc sulphide is required to be reconverted into sulphate for use again. The oxidation may be effected by injecting the zinc sulphide into an apparatus resembling a Diesel engine simultaneously with the intake of air; the temperature being controlled by water cooling. If the gas to be purified contains too little sulphuretted hydrogen, more is added by mixing calcium sulphate with the carbonaceous charge of the retort. Calcium sulphide is first formed, and is decomposed by the water which is injected into the lower part of the retort.



Incandescent Gas-Lamp.—No. 102,373.

SVENSKA AKTIEBOLAGET GASACCUMULATOR, of Stockholm.

No. 15,458; Oct. 30, 1916.

The patentees claim a form of lamp in which the combustion products are exhausted under pressure from the interior of the chimney or globe which surrounds the incandescent body A. The globe is hermetically secured by flanges to a casing provided with an outlet conduit B; and pressure is caused in the globe by supplying a gas-air mixture under pressure through the valved supply pipe C. Air may be arranged to circulate through the casing D.

Automatic Temperature Controlling Means.—No. 102,869.

TWELLS, A. H., of Leicester.

No. 5887; April 25, 1916.

This invention relates to means for automatically controlling the temperature of liquid heaters, steam heaters, radiators, and the like; and it relates to the type of thermostatic arrangement wherein the control is effected by a regulation of the supply of the heating medium brought about by the expansion and contraction of the heated body, or a member or members in or associated with the body.

The invention is particularly, though not exclusively, applicable for use with water-heaters employed in connection with warming apparatus for buildings. It may, however, be applied to other forms of heaters, such as boiling tanks, or vessels for heating liquids where temeprature regulation is desirable or necessary. Or it may be employed to control the temperature of radiators or similar apparatus. It is mainly intended for use with heaters or heating devices where steam is the heating medium; but it may also be employed to automatically control the supply of other heating mediums—such as gas.

Burning Gaseous Mixtures.—No. 102,983.

IONIDES, A. C., of Porchester Terrace, W.

No. 129; Jan. 4, 1916.

This invention relates to the burning of a combustible and a supporter of combustion mixed together "in correct proportions" and consumed in a closed furnace without additional air, and from which the cooled products of combustion are displaced downwards, as indicated in patent No. 15,455 of 1909.

In gas lighting and heating installations using a mixture of air and gas both supplied under pressure, or one injected by the pressure of the other, the patentee remarks that it has been proposed to supply a plurality of burners from two common mains running in parallel—each main being under the control of a valve in addition to the adjusting means provided at each burner or series of burners. It has also been proposed in such an installation to provide a burner with means for breaking up the current of mingled gas and air into a plurality of small streams, and (after uniting them) to subject the current to further abrupt deflection.

When using a mixture of two constituents—for example, gas and air, both at a pressure above atmosphere—in apparatus having a plurality of burners and provided with governing means, such as a movable diaphragm subjected on its opposite sides to the pressure of the constituents and by its movement operating valves which maintain a constant relation between the pressures of the two constituents, as described in patent No. 15,758 of 1913, it has been found convenient, he says, for obtaining a correctly proportioned mixture to provide means which are capable of controlling the area of the conduits at the point where mixing of the constituents occurs consequent upon the junction of the conduits adjacent to the burners. Such means, he points out, have taken the form of plug-valves, in which each constituent passes through a separate passage-way of adjustable area in the plug, as described in patent No. 5984 of 1915, according to which (in addition to adjusting the proportions of the constituents of the mixture) the supply can be controlled without affecting the proportions. In such a carefully

balanced arrangement, however, a variation in the quality of the combustible (as is always possible when using ordinary gas) necessitates readjustment of the valve which controls the supply to each burner.

The object of the present invention is to provide a distribution system of the type indicated in the preceding paragraph, and having increased facilities for compensating for any variation in the gas and simplified and improved devices for mixing the constituents.

The invention consists in "a distribution system for conveying at constantly related pressures above that of the atmosphere the separate constituents of a self-burning gaseous mixture to a plurality of adjustable mixing appliances associated with the jets of a multiburner heating device of the type before indicated, in which mixing appliances are fed from capacious conduits surrounding the heating device and communicating with each of the appliances—at least one of the conduits having means for adjusting the flow thereto, so that variation of a constituent may be compensated for without readjustment of the mixing appliances."

The invention also consists in a multiburner heating device using a mixture and operating as before indicated, and having an annular gas-conduit in combination with an annular air conduit, both encircling the axis of the heating chamber, and the supply to one or both being valve controlled—the conduits having separate branches and connections so arranged that each constituent is led separately to the mixing elements which are connected to the burners.

The invention further consists in a method of thoroughly mixing the constituents of an inflammable mixture to ensure complete combustion—consisting in maintaining, by pressure controlled means, a constant relation between the pressures of the constituents delivered to a distribution system, providing means for adjusting the areas of one or more of the separate conduits at any point at which the constituents mingle, and in creating vortices in the current of mingled fluids by deflection through a substantial angle in one or more different directions.

The invention still further consists in appliances for the production of a uniform self-burning gaseous mixture in which conduits for conveying the separate constituents converge and preferably enter tangentially a common annular mixing conduit or chamber, and, after deflection or rotation therein, are further deflected abruptly at substantially a right angle to the original direction by leaving the device by a co-axial orifice.

Charging Gas-Retorts.—No. 103,137.

WHITE, A. E.; a communication from the Riter-Conley Manufacturing Company, of Leetsdale, Penn., U.S.A.

No. 335; Jan. 7, 1916.

This invention relates more particularly to apparatus for operating horizontal retorts provided with a charging device or scoop capable of receiving and depositing successive charges of coal in the retort—the objects of the invention being "to produce gas at a minimum cost by establishing conditions whereby maximum efficiency in gas production shall be maintained uniformly."

In accordance with one feature of the invention, the producing of the successive charges in the retorts, and the final formation of each charge within the retort, are standardized on cross-sectional lines—that is to say, the charges are made each substantially alike, and constitute "a uniform product on cross-sectional lines, in contradistinction to being uniform by weight or volume alone." Not only are the charges the same by total weight or by total volume, but also as a shaped structure, so that a cross-section taken through one charge at a given point will be substantially the same as a cross-section taken through succeeding charges at the corresponding point. The charges are formed by separate manipulations—that is, the coal is subjected to successive treatments or handlings, always carried on under the same conditions; so that successive charges must necessarily be substantial duplications of each other, not only in the total amount of coal in the charge, but also in the distribution of the charge, both on longitudinal and cross-sectional lines, within the retort.

In accordance with a further feature of the invention, the standardization of the charge is predetermined to substantially co-ordinate with the retort heating so as to provide a definite relationship between the retort heats and the successive charges. This co-ordination of heats and charges is obtained, for instance, by varying the volume of material on successive cross-sections lengthwise of the charge to fit a particular condition of retort heating; but it is preferable to form the volumetric cross-sections of the charge approximately uniform and to effect the co-ordination through the heating conditions. This feature of the invention presents the advantage that, as a result of duplicating the amount of coal charged to the retorts, distributing the charge throughout the length of the retort to fit a plan of operation at maximum efficiency, and controlling the heating of the retort to fit the distribution of the coal therein, there will be produced complete and uniform carbonization of the coal of successive standardized charges throughout the operation of the generating apparatus—"thereby ensuring maximum results at minimum costs." Moreover, the necessity for frequently regulating the temperatures of the retorts on account of variations in amount of distribution of charges is said to be practically eliminated.

For further particulars of the patentees' proposals, readers are referred to the specification—extending (with the list of thirteen claims) to nine pages of print, accompanied by two sheets of closely-lettered diagrams.

Machines for Charging and Discharging Gas-Retorts.—No. 103,138.

RITER CONLEY MANUFACTURING COMPANY, CARPENTER, H. A., HIBBARD, R. L., and WARNER, A. W., of Leetsdale, Penn., U.S.A.

No. 336; Jan. 7, 1916.

This retort charging and discharging apparatus is of the type disclosed in patent No, 17,855 of 1912; the chief objects being "to increase the automatic cycle of operations of the apparatus, to provide for greater economies and safeguards in operation, and, incidentally, to facilitate and enhance the functions to be performed by the apparatus in order that the charging and discharging may be made with greater rapidity." The feeding and positioning of the charge within the scoop structure and the ultimate manipulation of the scoop structure for charging the material therein to the retort is "effected by a definite sequence of automatically controlled and timed motor operations."

In the preferred form of the plant, the operation of the scoop structure, and the mechanisms pertaining to it, is effected by a number of motors each provided with an automatic switch moving with the corresponding mechanism and adapted to automatically determine the time and sequence of the motor operations. Moreover, the arrangement may be such that the initiation or starting of the sequence may be effected by an individual controller adapted to be rendered active through a master controller. Also the successive operations may be manually controlled through individual controllers rendered active or inactive through the intervention of the master controller.

The machine is, moreover, such that while automatic control is provided, individual control is maintained to take care of difficulties; but protection is had against disturbance of the automatic action excepting by a deliberate manipulation of a master controller in advance of such individual control movements. This feature provides protection against accidental manipulation of the individual controls affecting normal automatic operation.

In order that the invention may be clearly understood, readers must—as in the case of patent No. 103,137, *supra*—refer to the specification itself, which extends to no less than thirteen pages of print, including fifteen separate claims, and describing two sheets of closely-lettered diagrams.

Apparatus for Charging and Discharging Retorts. No. 103,139.

RITER-CONLEY MANUFACTURING COMPANY, CARPENTER, H. A., HIBBARD R. L., and WARNER A. W., of Leetsdale, Penn., U.S.A.

No. 337; Jan. 7, 1916.

This apparatus is for retort charging and discharging of the character disclosed in patent No. 17,855 of 1912; the chief objects being "to facilitate the delivery of the material to the charger, to control the shape of the charge therein, and, incidentally, to enable the material to be delivered in a clean and reliable manner to the charger, so as to avoid the escape of dust and the inconvenience caused thereby."

The outlet end of the shoot conveying the material from the supply hopper to the horizontally movable charger is in this case spaced a fixed distance above the travel path of the charger, and the space between these two members is enclosed by a structure which is preferably carried by the shoot and adapted to be moved to and from such enclosing positions. The structure may comprise a number of pivoted wings adapted to be operated in unison by suitable actuating mechanism. In the preferred form of the invention, the shoot is formed of a series of telescopic members adapted to be automatically extended or collapsed during the vertical adjustment of the charger and the upper and lower members of which are fixedly secured to the hopper and to a vertically adjustable frame which also carries the charger.

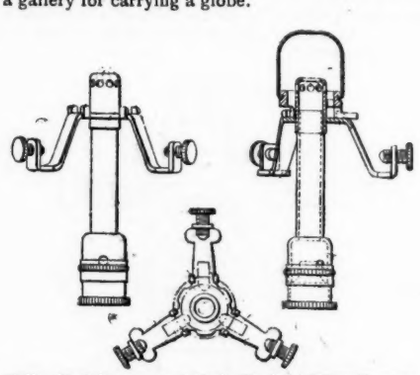
The specification of this invention—though not so voluminous as those of the two last given—Nos. 103,137 and 103,138—cannot usefully be abstracted apart from the two sheets of lettered drawings by which it is accompanied. Here there are only some four sheets of letterpress, including the six claims made for the invention.

Incandescent Gas-Burners.—No. 103,362.

FALK, STADELMANN, and CO., LTD., and FALK, G., of Farringdon Road, E.C.

No. 1806; Feb. 7, 1916.

The object of this invention is to provide means whereby mantles, such as are now used in connection with inverted burners, can be employed on a upright burner by providing on the head of the burner a platform on which the lugs of the inverted mantle rest as feet. The platform has preferably formed integral with it a series of arms which constitute a gallery for carrying a globe.



Falk, Stadelmann, and Co.'s Upright Bijou Burner.

It will be seen that the mixing chamber is at the lower end, as usual, and the nozzle, which is at the upper end, is somewhat in turned at its upper extremity, and provided with a series of lateral holes through which the jets of gas issue. The mantle is secured to a ring provided with a series of lugs which constitute feet, and the platform for supporting the mantle over the nozzle is formed upon, or fixed to, the nozzle, and is provided with a series of upturned lugs between which the feet lie, as indicated by the dotted lines.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following Bills were presented on Wednesday last, read a first time, and referred to the Examiners: Haslemere and District Gas, Hemel Hempsted Gas, Kenilworth Gas, Lea Bridge District Gas, South Staffordshire Mond Gas.

Petitions have been deposited by the Hertfordshire County Council against the Hemel Hempsted Bill, and by the Leyton Urban District Council against the Lea Bridge District Gas Bill.

HOUSE OF COMMONS.

Petitions against Private Bills.

Sheffield Gas Bill, by the Sheffield Corporation, the Great Central Railway Company, and the Rotherham Corporation.

South-Eastern and London, Chatham, and Dover Railways Bill, by the Gas Light and Coke Company, the South Metropolitan Gas Company, and the Wandsworth, Wimbledon, and Epsom District Gas Company.

Bills Read a First Time.

On the 12th inst., the following Bills were presented, read the first time, and ordered to be read a second time:

Blackpool Corporation, Gas Light and Coke Company, Sheffield Gas Company, South Eastern, &c., Railway.

Rental of Gas Appliances at Tottenham.

Major NEWMAN asked the President of the Board of Trade whether his attention had been drawn to the fact that the Tottenham District Light, Heat, and Power Company had recently decided to increase the rental of gas-stoves and other fittings already hired-out to the consumers in their district by 25 p.ct.; whether such increase had to have the sanction of the Board of Trade; and whether he was prepared to allow an increase in the rental of a gas-stove when a landlord was forbidden to raise the rent of his house to his tenant.

Mr. ROBERTS: I am informed by the Company that the amount of the rental of gas-stoves, &c., is a matter of agreement between them and consumers; and that it covers, not only the interest on the original cost, but also the cost of repairs, which has risen by reason of the war. The increase is not subject to any sanction on the part of the Board of Trade.

Tottenham Calorific Power Order.

Major NEWMAN asked the President of the Board of Trade whether, without hearing the local authorities, who had intimated their desire to be heard, the Board, on the 11th ult., made an Order, at the request of the Tottenham District Light, Heat, and Power Company, abolishing the illuminating standard of their gas and substituting a calorific standard of 500 B.Th.U. per c.ft. If so, whether he was aware of the dissatisfaction felt by consumers at the lack of pressure and the adverse manner in which many meters worked; and whether he would have immediate inquiry made into the complaints.

Mr. ROBERTS: Application has been made to the Board of Trade by the Company for an Order under the Gas (Standard of Calorific Power) Act, 1916; and objections have been lodged by some of the local authorities concerned. There appeared to the Board to be no need for a formal inquiry; but they gave full consideration to the representations made to them in writing by the local authorities, to whom they sent the draft of an Order which they proposed to make substituting a calorific standard of 500 B.Th.U. for the existing illuminating standard, and increasing the statutory minimum pressure at which gas is to be supplied. The Board have not yet made the Order; and, before doing so, they propose to consider any observations on the draft Order which the local authorities desire to submit.

Lighting Regulations and Street Accidents.

Mr. PARTINGTON asked the Home Secretary whether his attention had been drawn to the increase in accidents due to the darkened streets; and whether he would consider the advisability of altering the regulations so that the streets might remain lighted up to 8 p.m.

Sir G. CAVE replied that the question of lighting had been carefully considered in consultation with the military authorities; and on Jan. 25 he made an order under which the general lighting restrictions would not take effect until 7.30 p.m. in March and 8.30 p.m. in April. An alteration had also been made in the method by which the public lamps in London were obscured. This, it was believed, would improve the diffusion of light from the lamps, without increasing the danger of attack from the air.

Exeter Gas Company.—The annual general meeting of this Company will be held next Monday, when the accounts to be presented show that the balance to be carried from the revenue account to the profit and loss account is £9962. An interim dividend for June was paid—amounting to £3662; and after satisfying debenture stock interest, &c., there will be an amount to carry forward of £9162, less the dividend for the second half of the year—£3879. The usual dividends of 10 p.ct. on the original stock of £40,000 and of 7 p.ct. on the new ordinary shares (£46,500) are recommended, less income-tax. The report states that the sale of gas last year showed a decrease of 5·88 p.ct., due to the restrictions placed on public and private lighting, the Summer Time Act, and the general desire to exercise economy at the present time.

LEGAL INTELLIGENCE.

"STILL" PATENTS FOR COKE-OVEN BYE-PRODUCTS.

In the Patents Court last Thursday, Messrs. Bagley, Mills, & Co., Ltd., of Westminster, continued their applications for licences to use Carl Still's patents for obtaining bye-products of special value at the present time from coal and coal gas. On Nov. 3 last [as reported in the "JOURNAL" for Nov. 7, p. 301] they asked for licences to use five patents for coke-ovens. They now applied for two more patents —No. 22,862 of 1910, for "Apparatus for Distilling Hydrocarbons Dissolved in Tar Oils," and No. 23,459, of 1910, for "Improvements in and Relating to Coke-Ovens." The patentee, Carl Still, is a Prussian.

Mr. BLOXAM, Chartered Patent Agent, presented Messrs. Bagley's case; the patentee being represented by Mr. JUSTICE.

Mr. BLOXAM observed that, in obtaining benzol and allied hydrocarbons direct from the distillation products of pit coal, the hydrocarbons are eliminated by a washing process by means of tar oils. From this process arises the problem of, in turn, separating these hydrocarbons from the wash-oil by heating and distillation. This process, for which indirect steam heating is resorted to, has the drawback that the heating pipes through which the steam passes are subjected to considerable wear and tear by the tar oils, especially in the case of coke gases containing a high percentage of ammonia. They therefore require to be frequently renewed. The patent enables these exchanged defective parts to be carried out without inconvenient interruptions and stoppages. Great simplicity of construction is obtained; and the oil-heaters are made entirely separate from the column apparatus required for distilling. The patentee contrived to heat the wash-oil before it went into the apparatus, so as to limit to a minimum the heating which took place in the heating coils of the apparatus itself. The upright cylindrical oil-heaters had each in its interior a spiral heating coil, which was of easy access for the purpose of exchange or renewal. One of the oil-heaters at a time could be temporarily put out of action without a stoppage of the working. The oil-heaters were arranged in front of, and separate from, the distilling column. The Board of Trade had granted Messrs. Bagley, Mills, & Co. a licence to manufacture under the five patents they had already brought before the Court. They were to have the licence under a royalty of 5 p.ct. on the invoiced sale price of the apparatus installed.

The CONTROLLER (Mr. Temple Franks) said that Messrs. Bagley Mills, and Co. had already applied for a process for cooling under distillation, at an intermediate stage; a reflex condenser; and a stirring or mixing apparatus. He did not wish to minimize the invention; but it seemed to him that their present offer of a further 5 p.ct. royalty, as before, was rather a generous one in the circumstances.

Mr. BLOXAM replied that Messrs. Bagley, Mills, and Co. regarded the present invention as on a different footing from the other cases. It had nothing to do with the still—only with the heaters. They would ordinarily sell them together; but the heaters might be adapted to existing stills. Patent No. 23,459 related to improvements in horizontal coke-ovens provided with vertical heating flues, which were supplied with the heating gas from below, and into which the combustion air was admitted parallel to the gas by passages in the transverse walls or "binders" of the heating flues. The combustion air was previously heated to a high temperature, either by regenerative or recuperative process. Hitherto it had been a disadvantage that, at the point where the heating gases were burnt, so high a temperature was engendered that the refractory bricks constituting the walls of the flues were frequently caused to fuse. This disadvantage was overcome, under the patent, by the bricks in the combustion zone being cooled by the air for combustion and by the provision of a gradual combustion of the heating gases, so realized as to prevent the formation of transversely directed blow-pipe flames. The heating flues were each supplied with air at different levels; and so the combustion area was increased. The combustion took place more regularly up the whole length of the flue. There was more than one inlet of air; and the unburnt gas as it went higher was burnt by the air coming through the passages above. Again, Messrs. Bagley, Mills, and Co. offered the 5 p.ct. royalty.

Mr. JUSTICE complained that the royalty was apparently to be paid only on what was sold. The applicants might manufacture and not sell. As a matter of equity, if they wanted to manufacture for their own use or to store they should pay the royalty as well.

Mr. *Bagley* said he would undertake to pay royalty on all he manufactured and used for his own purposes.

After some argument on the question as to payment of the fees for the upkeep of the patent,

The CONTROLLER announced that he should recommend that Messrs. Bagley, Mills, & Co. be given the licences for which they applied.

LIABILITY FOR AN ACCIDENT WITH "GASCOLITE."

Action against the Coatbridge Gas Company.

Evidence was led at Airdrie last Tuesday in the action, debated a fortnight ago as to its relevancy [*ante*, p. 259], in which Miss Agnes M'Laren sued the Coatbridge Gas Company for a sum of £20 damages for loss and injury by the alleged explosion of a tin of Clark's "Gascolite," which she purchased from defenders' show-rooms. Defenders pleaded that the action was irrelevant.

Mr. T. W. JOHNSTON appeared for the pursuer; and Mr. JOHN M'LACHLAN represented the Gas Company.

Dr. *J. S. Rennie* spoke to attending the pursuer. She had now completely recovered; and there was no further danger.

Miss *M'Laren*, the pursuer, stated that she purchased the tin of

"Gascolite" in the defenders' show-room. The tin showed some printed instructions as to how to use the contents; but nothing was said about how to open it. None of the Gas Company's servants in the show-room told her how to open it, nor warned her that there was any danger of it exploding. Failing to open the lid with her fingers, she began prising it up with the point of a pair of scissors, when the lid suddenly flew off and there was a loud report. The lid struck her on the face, smashing her eyeglasses, and smearing her face and left eye with the contents of the tin. Her father took the broken glass from her eyes, and sent for Dr. Rennie. She was afterwards treated by a Glasgow specialist. She suffered great pain and nervousness for a month, and was two months confined to the house. She had now entirely recovered. The fees of the doctors, the cost of another pair of eyeglasses, and the account for motoring to Glasgow, made up the sum she now sued for,

In reply to the SHERIFF, the pursuer said she bought the tin after reading the advertisement in the Gas Company's show-room. It was the "Gascolite" people's advertisement. She did not notice any flame when the lid flew off. It was the contents of the tin that burned her. It went off like gunpowder.

Mr. *Peter M'Laren*, father of the pursuer, corroborated his daughter's evidence. He declared that when the lid of the tin was prised up it went off like the shot of a gun.

Mr. *George Braidwood*, the Manager of the Gas Company, stated that some time ago, before he became Manager, the Company had a few tins of the cleaner in question on sale in their show-rooms. It was not made by the defenders, but by Clark's Lead Company. A few tins found their way into the windows of the Gas Company's show-rooms, with an advertisement recommending the article as a good substance for the cleaning of grates and stoves. The advertisement was Clark's, not the Gas Company's. He was not aware that the Gas Company gave any guarantee along with the stuff in selling it. There was no difficulty in prising open the lid of the tin. It was possible some of the stuff might squirt out if the tin were handled carelessly. The defenders had sold many similar tins, and had had no experience of difficulty. He found that Clark's people had had no accidents of this kind with their tins.

In cross-examination, witness stated that when Mr. M'Laren reported the matter to the Gas Company, he had an examination made of the remaining tins in stock. They were all tried, to see if they could get an explosion; but they failed in producing one by opening the tins with a screwdriver.

Mr. *David Lambie*, the Secretary of the Gas Company, spoke to having had an examination made of the remaining tins of "Gascolite" that were in stock. The foreman at the gas-works opened them, and reported to him that no explosion took place when he did so.

This concluded the evidence.

Mr. JOHNSTON argued for the pursuer that it did not matter whether the card advertising the tin was by Clark's Company or not. The tin was being sold by the defenders; and if pursuer bought in their shop an article which ultimately did her damage through no fault of her own, but by fault either of commission or omission on the part of the seller, then the seller was responsible, and there was no need to go to the makers of the article.

The SHERIFF differed from Counsel in his arguments. He contended that pursuer went into the shop and asked for a tin of "Gascolite." She did not ask any advice, and took all the risks of the purchase. This was a risk she took in ordering the article on the strength of the advertisement.

Mr. M'LACHLAN, for the defenders, said they were not a whit further forward than they were a fortnight ago, when he took exception, as he still did, to the relevancy of the complaint. The proof had not helped the pursuer at all. No relationship had been established between the pursuer and the defenders implying guarantee on the defenders' part for the article sold.

The SHERIFF said he would consider his decision along with any authorities on the question of law which Mr. Johnston might submit, and give judgment next week.

Gas Company's Secretary Summoned.—Mr. William H. Allen, the Secretary to the Dursley Gas Company, was summoned at the local Sessions, by Thomas G. Hoare, for committing wilful damage to his door, to the extent of 3s. 6d. Complainant said that one morning he locked his house as usual before going to work, and on returning to dinner found the door had been forced open and the lock broken. Defendant, when questioned, said he found the door unfastened, and then admitted that he was wrong in entering the house, though it was a general rule for him to go in and inspect meters. For the defence, Mr. Wenden contended that defendant had a right to enter the house, under section 21 of the Gas-Works Clauses Act, 1871; and that was all he did. Mr. Allen, on oath, denied breaking the lock; stating that he found the door open. The Bench held that it had not been proved that Mr. Allen broke the lock; and they dismissed the case. Mr. Wenden intimated that the Company would not ask for costs.

Longwood and Slaithwaite Gas Company.—The Directors of this joint concern (amalgamated in 1914), in view of Monday's meeting of shareholders, report that the quantity of gas sold during last year was 176,677,700 c.ft.—a decrease on the preceding year of 15,350,900 c.ft., or 8 p.ct. At the end of the year there were gas heating and lighting appliances on hire totalling 4181; while the number of ordinary meters in use was 4790, and slot meters 4424. The price of gas was advanced 3d. per 1000 c.ft. from July—rendered necessary by the continued rise in the prices of all materials and labour. The lighting restrictions also diminished the gas sales. The Directors record that notwithstanding great difficulties the new manufacturing plant was in such an advanced state at the end of the year as to enable gasmaking to be commenced. The amount expended on capital account during the past year was £12,813, of which £12,056 was spent on new works, £672 on new mains, and £85 on new meters. A dividend of £2 7s. 6d. p.ct. on the consolidated ordinary stock (Longwood), and of £2 2s. 6d. p.ct. on the Slaithwaite stock is recommended for the December half year, being at the statutory rate. Dividends for the June half year were paid at the rate of £2 11s. 3d. and £2 6s. 3d. respectively.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of the Proprietors of the Company was held on Wednesday last, at the Cannon Street Hotel—Mr. CHARLES CARPENTER, D.Sc., in the chair.

The SECRETARY (Mr. F. M'Leod) read the advertisement convening the meeting, and the minutes of the last ordinary and extraordinary general meetings. The seal of the Company was then affixed to the "Register of Proprietors."

THE CHAIRMAN'S SPEECH.

The CHAIRMAN: Ladies and Gentlemen,—Presuming that you will, as usual, take as read the accounts and report for the past half year, I will, before moving their adoption, deal with a few matters of interest arising out of them. The first paragraph shows our position at the end of the half year. We are in a position to pay the dividend allowed us by the sliding-scale (substantially lower though it is than in pre-war days), to strengthen our insurance reserves to the extent of £19,000, and to carry a balance of £33,660 forward to the current half-year's working. The latter figure is substantially larger than a year ago, though it is £12,056 less than at Midsummer last. We have, in effect, therefore, an actual debit balance on the half-year's working of this amount, which is not unsatisfactory having regard to the difficult circumstances under which we have been working. Whether we shall be able to get through the current year without raising the price of gas, it is impossible to say. It all depends upon the freedom with which we can carry coals to our works from the North; and as to this, no man can prophesy. Fortunately, with the lengthening days the duration of voyages is shortening, and we hope we have passed the worst in this respect. As most of you know, we are not able to run our colliers day and night from the North to the Thames; one of the restrictions being that they should only travel in daylight. As the days grow longer, the ships will be able to make their voyage in a shorter time from the Tyne to the Thames; so that we shall get more work out of them. The report then mentions our proposals with regard to the insurance fund. For many years we went on with this at about £100,000—an amount which seemed ample for our needs. About three-fourths of it was, however, swallowed up as a result of the coal strike, when we used it—and I think properly—to level-out the heavy and exceptional cost of meeting our requirements in coal; and our idea was to gradually bring it back to the old figure. But arising out of the war, we have been embarking upon a policy of becoming our own carriers of coal—copying the excellent example set by our smaller neighbour across the water. We have thus introduced into our safe, steady-going business of gas-making the disturbing risks pertaining to shipowning. We are insuring against losses under this head by war and by marine policies; and until we have built up a substantial fund of our own, no other course is possible. Rates are, however, exceedingly high; and when we have ourselves provided a substantial sum—as we are entitled to do by our Act of Parliament—we shall in all probability become our own insurers, perhaps in collaboration with other undertakings having similar responsibilities.

GAS-COOKERS AND THE WAR.

The report goes on to deal with the consumption of gas; and the figures given in it will, I think, enable the shareholders to answer for themselves a question they might not unnaturally put, "How is the business suffering by the war?" I need not remind you that the restrictions as to lighting during the six months ending December last were more severe than in the corresponding period. The reduction in the domestic consumption alone of gas we estimate at something like 10 p.ct. compared with normal times. But while the war has brought about a diminished use of gas under this heading, it has been more than compensated for by the increased requirements of industry arising out of it. This has been a very helpful equalization for us, as we have been able to keep something like our normal amount of plant in profitable action. While on the subject of gas consumption, I should like to point out the important aid of the gas-cooker in helping to win the war. It is not only that the heat energy it utilizes is, so to speak, a surplus product remaining after the extraction of the bye-products from the raw coal required in munition making, but it has helped enormously in solving the problem of labour supply to these manufactories. For the worker there are at least two essentials—housing and feeding. The gas-cooker enables the fullest use to be made of every existing building by its subdivision into smaller tenements, and rendering the worker at the same time independent in the matter of food by providing therein immediate cooking facilities at all hours of the day and night.

WORK OF THE STAFF.

The next paragraph might very well have come in early in the report; for it is an acknowledgment that such a favourable balance-sheet could not have been presented to-day but for the unstinted efforts of the staff, and I must specially single out those concerned in engineering and chemical work. Their devotion has been untiring. They have been short of men, short of material, and defects have revealed themselves which were unnoticeable in times of peace and less strenuous working. But they have applied themselves to the ever-growing problems with diligence and intelligence, and I am pleased to say with a great measure of success. I hope it may not be out of place to acknowledge here, as the Board have already done by resolution, the loyal service, extending over 47 years, of Mr. J. F. Braidwood, who relinquished at Christmas the charge of our works at Greenwich.

COAL AND COKE.

The next paragraph of the report deals with a serious factor overshadowing all others in the conduct of the undertaking—namely, the supply of coal. We have in the past regarded the provision of adequate stocks of coal as of paramount importance, and we have spared neither

convenience nor expense in carrying out this policy. Our practice has been to accumulate large stores on our land at East Greenwich, to reload this as required, and transport it by our barges to the up-river stations. Unfortunately, stocks have now fallen, from causes entirely outside our control, to what we regard as a danger point. This is recognized by the authorities, who are doing their best to help us out of the difficulty. We have been in communication with the Board of Trade and with the London Committee who advise on the responsibility of coaling the Metropolis. Yet while our stocks of coal are rapidly dwindling, our stock of coke, which is an equally good fuel for most purposes, increases day by day. There is no doubt in my mind that a position of affairs has now arisen when the use of raw coal should be subject to licence, as is already the case with petrol. I agree that for many purposes gas coke may not be so convenient. As it is not bituminous, it does not light so readily, and some prejudice exists against its use. But we are dealing to-day with necessities, not conveniences; and one of those which should certainly be largely dispensed with in the present crisis is the open coal-fire. During war these might well be restricted, and the coal which is brought to London for such use should be diverted to the gas-works, there to extract the bye-products which are so urgently wanted for the war, and return the coke to the present distributors of coal. In this matter I am not speaking as the chairman of a gas undertaking hungry for profits. Whatever may be decided on, it is impossible that London gas undertakings should, during war time, return to their shareholders as much in dividend as in pre-war times. But the proper utilization of every ounce of our raw coal is a national necessity. We do not need to wait for new processes of unproved utility. The gas undertakings have the plant ready to hand for the purpose; and this should be utilized to its fullest capacity, instead of being allowed to lie idle, as so much of it does, during the lighter months of the year. In June, 1915, as a member of a deputation received by a large number of members of the House of Commons in one of its Committee Rooms, I urged the view that all fuel should be thus treated before use during the war. But this winter's thick fogs are sufficient evidence, if any were needed, that the suggestion has not yet been acted upon.

A COAL CONTROLLER WANTED.

The fact of the matter is, we want for London a Coal Controller who will put its fuel supply upon a war emergency basis and be independent at the same time of the importunities not only of the users, but the merchants and distributors, of coal. Much of the large machinery which already exists for this purpose should be switched-over from coal to coke, in respect of which a maximum or standard price at the producing centres might well be fixed, as has been advantageously done with coal. The supply of coal for London, which is a matter of very great importance, I think should be under the control of one man, very much as the food supply is now. If we could get some strong, able man, as we have got in the case of food, and the various requirements were brought under his notice, and he would set himself out to utilize the whole of the resources in the country's interest—because that is what we want—I think it would be very helpful in the present crisis. There is already large machinery available for the supply of coal; and my suggestion is that this should be utilized for the distribution of coke. I do not think you will displace the whole of the coal; but a very large reduction could be made in its use in London. In other words, to apply the same system which has been commenced, we do not know with what success, to reduce food consumption. I see in the papers this morning there is some suggestion that the coal production will be put under Government. It seems a very curious thing that only the monopoly of gas making is regulated by the State—the more we charge for gas, the less dividend we can pay. But the case of coal, which is another monopoly, is an unregulated one; for the more money that can be made out of it, the more the holders of shares in collieries are allowed to take. Quite a diametrically opposite policy is applied to coal than to gas; in the one case the lower the price the greater the dividend, and in the other the higher the price the greater the dividend.

WOMEN WORKERS.

There is an opening sentence in the next paragraph of the report as to which I hope at some future (I wish I thought near future) day to dwell upon. It must suffice for the present to say that the staff of officers and workpeople has lived up to its traditions (for a new generation has come into existence since the founding of our co-partnership). Nor must I forget to mention the women workers, who have so loyally come to our aid in all directions. They are helping us in nearly every department to the number of something like 1000. To what extent they have come to stay is one of the questions which must wait an answer until peace comes. In this respect, as in some others, the war has set us thinking; and we shall be able to work out the problem for ourselves unfettered by the prejudices of the past, yet with the experiences of the present. Resolutions pertaining to the final paragraph will follow in their usual sequence.

SOME ITEMS IN THE ACCOUNTS EXPLAINED.

Before I formally move the adoption of the report and accounts, there are one or two items in the latter as to which a few words of explanation may be desirable. Under the heading of "Manufacture of Gas," it will be noticed that "Repairs and Maintenance of Works" charges are now returning to nearer the normal figure, as we are commencing to deal with some of the arrears which accumulated in the first year of the war. Distributing charges are low, owing to the suspension of a great deal of work usually carried out. The item "Co-Partnership" is also double the corresponding figure. But as the amount is based upon the same sliding-scale by which the dividend is regulated, we can share the satisfaction at this increase. The other item on this side to which I ought to refer is that of war bonus and war fund, which has increased by the large figure of £33,500. We have followed the lead of the Government in this respect, believing it to be right and proper that something of the increased cost of living incurred by the employees should be borne by the consumers of gas and the shareholders in the Company. We have also continued the practice of writing-down the reserve funds to current prices, which accounts for a fall in value compared with last Midsummer of £15,000. We also realized a considerable portion of these securities, as we felt that, in the special circumstances, the money could most usefully be employed in our business. This brings me to an important matter—namely, as to working capital.

THE QUESTION OF FINANCE.

If you will look under No. 5 heading of the statement of accounts, you will see that our capital balance unexpended is only £109,000. Now, I need hardly tell you it is absolutely impossible to carry on a business of the magnitude of this one with such a small amount of working, or cash, capital. For instance, take the bills falling due at Christmas; these amount to something like half-a-million pounds in themselves; and we have to provide in advance the raw material and labour required in manufacture. Obviously, we could not do this with a balance of little over £100,000, assisted though it is by the use of our uninvested funds. The position is aggravated by the fact that, though we receive better prices for gas and products, we have to pay higher ones for raw material and its freightage. We are in a position, therefore, of having a buoyant business which has stood up well to the shocks of the last two and a half years, and is in a thoroughly healthy condition; and yet we are inconveniently short of money with which to carry it on. That is the meaning of the large recurring figure of "Temporary Loan" in statement No. 12, which amounts to £360,000. Now, it was for this reason that we obtained your sanction to our proposals to increase our borrowing powers independently of our capital ones, for the need for this extra money will undoubtedly cease when prices return to a more normal level. In this way we have power to borrow in any manner most desirable up to £500,000; and it is not improbable that we may have to exercise this to a considerable extent during the current year. To put it shortly, we are in possession of an exceedingly stable and valuable business; but our capital lay-out has not been based upon war-time requirements.

THE WAR LOAN.

Lastly, you will be interested to know our attitude with regard to the War Loan. We have given our employees of all grades facilities for purchasing the stock; and, in addition, we have taken up, on behalf of the undertaking, £250,000. These last matters are not, strictly speaking, concerned in the period under review: but I thought you would like to be told our attitude with regard to them.

I now beg to move that the report and accounts now presented be received and adopted, and the report entered on the minutes.

The DEPUTY-CHAIRMAN (Mr. Frank H. Jones) seconded the resolution.

REMARKS BY SHAREHOLDERS.

Mr. HAVELOCK WEST said in looking through the balance-sheet he noticed there was an increase in the balance of £12,000, which he thought was very satisfactory. The insurance fund balance of £60,000 also had grown to £77,000. He presumed that in the next year a sum of £22,000 would be added to this fund. The Chairman had so clearly stated the points as to temporary loans and investments, as to which he had intended to ask some questions, that there was now no necessity to do so. Considering they used a million tons of coal each year, the work which had to be done to bring this quantity from the North of England to their works in the South was a large business indeed. Referring to the employment of females, he said he considered they had done remarkably well in every business; and he hoped that, when the war was over, the Company would take into serious consideration the question of continuing the employment of women. Being connected with shipping, he noticed the other day that one of their large boats went down; and he trusted the Directors would take steps to have it replaced as soon as possible.

Professor ARMSTRONG said that, though satisfactory apparently in its financial results, a more meagre, less informative report could not well have been laid before them. The story buried in paragraph 5 alone probably would take long to tell. They could all imagine that there must have been great difficulty in obtaining supplies of coal; but not a word was said of the demand made upon the Company during the dark days at the close of the year. Great efforts must have been needed to overtake them; and there must be men on the staff whom they should thank specially for the service they then rendered. His object in speaking, however, was to direct attention to a really serious topic. Some of them might have seen articles of his in "The Times" Trade Supplement dealing with the improvident use of coal and with the future of gas as opposed to electricity. He wanted to warn them very seriously that great changes might—indeed, would—be forced upon the industry in the near future. The method pursued of making gas was one only to be described as barbaric; and great changes must ere long be made. They were told in the report merely that "It is unfortunate that to-day the use of raw coal is permitted without licence or restriction, although the wasted bye-products are urgently needed for war purposes by the nation." Quite so. But why had not the gas companies taken this matter in hand years and years ago, and set an example? By low-temperature methods they might easily have made gas below pre-war prices, and at the same time produced a smokeless fuel such as the public needed, the use of which would put fogs such as that of Christmas out of court. What had the Company done to think-out these problems? They were no longer merely a gas company he believed—they were also chemical manufacturers. To what extent were they looking ahead in this branch of their work? He raised these questions in order to impress on shareholders the inadequacy of the present directorate. However able the directorate might be in the ordinary affairs of the Company, they could not have any feeling for issues such as those to which he had called attention. He suggested that expert electrical and chemical opinion should also figure upon it.

Mr. JACQUES ABADY thought it only fair to say that the opinion of men competent to judge in regard to the affairs of the Company was that the method pursued by them of making gas was not "barbaric," as described by the last speaker. It was only right that such a statement should be contradicted.

REPLY OF THE CHAIRMAN.

The CHAIRMAN: If no other shareholder has any remark to make, I will now reply to the observations made by the various speakers. I

will take first the question as to the insurance fund. I do not think that our pre-war idea of the amount required for this fund is our idea to-day. We shall go on, if all goes well, adding to our insurance fund something about the extent to which we are entitled to do by Act of Parliament—viz., about £40,000 a year. We want to build this fund up into a condition which more adequately meets our wants to-day than in pre-war times. Whatever our sins of omission or commission have been, we have broadened our outlook with regard to coal carrying. At one time it was said, "Why don't you own your own ships?" The answer was that it was a special business, that the cost of freight had been reasonable, and, upon the whole, we thought it better to go on as we had been doing. Of late years, however, we have extended our views in this respect, and we do, as a matter of fact, to-day own a fleet of colliers; and we shall insure them ourselves. I have in my mind a figure of nearer £300,000 than £100,000, which was the pre-war amount. With regard to depreciation of our investments, this is a matter in which we are helpless. Nearly everything has fallen; and instead of retaining them at the figure at which they stood in the balance-sheet, we preferred to write them down. With reference to the sale of some of our securities, I am glad to say we obtained a better price by acting on the advice of a member of the Board who has had great experience in these matters, for I must remind you that you want not only chemical and scientific knowledge but commercial ability too. By following the advice of our colleague, we sold our securities at a good figure, and are now using the money profitably in our business. With regard to the employment of women, we have our eyes open. The extent to which we shall continue this employment, we cannot yet say; but we certainly shall continue to employ women, as they have done admirably. In regard to ships, our settled policy is that if one goes down we buy another; and this policy we have acted upon. With regard to our methods of gas making, I think everybody will agree that they are not perfect; but we can at least say of them they are practical, and, like threatened things, they have lived for a good many years. Some of the processes which have been suggested during the past year, to take the place of the methods usually employed, I have inspected. I thoroughly examined a very familiar one, and came to the conclusion that it was entirely unsuitable for gas making in London. For aught I know, the process may be improved; but we are commercial people, and do not shut our eyes to possibilities. If a better process for the distillation of coal is evolved, it will soon be brought under our notice, as we are the customers for it. The people with money behind them are ourselves; and if a process is worked out which can stand the light of day—I am not speaking of wild-cat schemes—I cannot doubt that gas undertakings will be the first to whom it is offered. In one respect I do plead guilty, and that is that we might certainly have done more in the past than we have in investigating these problems. We accepted the general principle of carbonizing coal which had proved successful for a hundred years; but there are many problems about carbonizing coal which I quite agree we ought to know but which we do not know. For some years we have been building up a scientific staff to deal with these problems. We are no worse off than the users of dyes, who were content to get them from abroad as long as they could. We began before the war to lay the foundation for something better. Our possibilities are limited not by money but by men. I think I have now dealt with the points raised by the different speakers; but I should like to say in conclusion that in every respect, when I have asked for new problems to be tested, I have had the absolute and unhesitating support of the whole of my colleagues on the Board.

The motion was then put, and carried unanimously.

THE DIVIDEND.

The CHAIRMAN: I have now to move:

> That a dividend at the rate of £4 13s. 4d. p.ct. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post.

Mr. JOHN MEWS: I beg to second the proposition. I think it is a result of which you may all be justly proud. The ordinary stock returns £5 12s. 6d. on the present price of 78. This return depends entirely on what is the credit of the country for the time being. The credit of the country now is, as you know, 5½ per cent. Our Company cannot, of course, compete with that return. We cannot expect to have a higher return for our shares than the country asks, and will obtain. With regard to the new War Loan, I think everybody should convert all the old 4½ p.ct. loan. The Exchequer bonds should be handed over also, and the Treasury Bills, which happen to be a particularly extravagant form of finance. I rather deprecate the naming in the newspapers of the large amounts subscribed by different people, as it may prevent the smaller investors from assisting. If a man can save 2s. a week, at the end of the year it becomes £5; and if there were 10,000 men doing this, you would have £50,000. It is not the large companies and investors who will really provide the means to supply the country; it is the smaller people. If some scheme could be formulated by which the 2s. per week could be received and then the stock handed to the subscriber at the end of the year, it would be a great benefit to the country. There is a little bit of the bull-dog breed in me, as I hope in most of us; and when we get hold of a thing, we want it carried through. The Germans want to see the loan a failure; but we must all try our level-best to see whether it cannot be made a success. If you do all you can, it will be a huge success. From what I hear, the loan is going very well indeed.

The motion was put and carried unanimously.

RE-ELECTION OF DIRECTORS AND AUDITOR.

The DEPUTY-CHAIRMAN: The next resolution is that Mr. Charles Carpenter be re-elected a Director of the Company. However unworthy some of us may be to be on this Board, I can only strongly advise you to vote for the re-election of our Chairman, as he is indispensable to the Company. There are many things he has done for the Company and the country during the last three years; and those are things which, in the future, I may be able to tell you about. At any rate, I strongly advise you to accept this resolution.

Mr. FRANK BUSH: I beg to second the proposition. Mr. Carpenter has now occupied the chair during eight strenuous years; and he has shown himself to be without any doubt the right man in the right place. He is held in the highest esteem by all his colleagues for his many and sterling qualities. Without further words, let me say it gives me very great pleasure to second the re-election of Mr. Carpenter as a Director of the Company.

The resolution was passed unanimously.

The CHAIRMAN: Ladies and gentlemen, I am very much obliged by, and thank you very heartily for, the way you have accepted the resolution. I now move that Mr. Kenneth Phipson Hawksley be re-elected a Director of this Company. We took Mr. Hawksley upon the Board as an expert in matters which were very essential to our business; and the expectations we formed of him at the time of election I can assure you have been realized. It gives me pleasure to propose that a technical and qualified man like Mr. Hawksley be re-elected a Director.

The DEPUTY-CHAIRMAN seconded the resolution, which was put and carried unanimously.

Mr. HAWKSLEY expressed thanks for his re-election.

On the proposition of Mr. PASSMORE, seconded by Mr. RICHARDS, Mr. Charles Pelham Crookenden was re-elected an Auditor of the Company.

Mr. CROOKENDEN briefly returned acknowledgment for his re-election.

The CHAIRMAN: That is the whole of the business of the meeting.

VOTES OF THANKS.

Mr. JACQUES ABADY moved a hearty vote of thanks to the Board for their services during the past six months. He felt sure they had had a very strenuous and trying time; and the excellent result they had shown amply justified the proprietors in passing the vote.

Mr. W. RICHARDS seconded the motion, which was carried unanimously.

The CHAIRMAN: On behalf of my colleagues and myself, I thank you most heartily for this vote of thanks. We have passed through a very trying and strenuous period, and I do not know that it gets less strenuous and trying as time goes on. In this respect we have felt the very great value of the staff, to whom the details and working of the business has been entrusted. To a great extent we owe this to the fact that they were born under the co-partnership tree planted by Sir George Livesey, and which has borne such excellent fruit. I cannot believe that any undertaking has been better served than ours by the staff, to whom we are indebted for so much of our prosperity. I hope you will allow me to propose that the best thanks of the meeting be given to the staff, officers, and workmen for the admirable manner in which they have helped forward the interests of the Company during the past six months.

Mr. CROOKENDEN seconded the motion, which was put and carried unanimously.

Mr. G. M. GILL (Chief Engineer), on behalf of the staff and workmen, returned thanks. He said he should like to take the opportunity of saying the men had worked splendidly during the half year, and responded to every call made upon them. Having been in the Company's service now for a year, he had found that he was working with an extremely genial body of men, and that there was no difficulty in working together in a friendly spirit. Of the present employees, only about 40 p.ct. were working for the Company at the outbreak of war. But these were largely experienced men, and had made up in quality what they lacked in quantity. It might interest shareholders to know that there had been a great demand for gas during the past two-and-a-half months; and from the beginning of December to the present date they had had to use 45,000 tons of coal more than last year, and a quantity considerably in excess of what was used in pre-war times. This excess quantity as compared with last year would be sufficient to supply a town the size of Nottingham. They were now employing a large number of women and boys, amounting to nearly 1400; and these new employees had been a great help. He also wished to acknowledge the very valuable advice he had always received from the Chairman when in doubt as to what should be done.

Mr. F. M'LEOD (Secretary) acknowledged the vote of thanks for the clerical and commercial section of the staff, remarking that they had all worked with zeal and devotion during a period of exceptional strain. With regard to the Company's war fund for assisting the dependants of the men who had joined the Colours, attention was called to the fact that the previous week payments were made to adults and children amounting in all to £562, of which £260 was raised by the employees. This made the total sum paid to date about £60,000. Some 2500 of the Company's men were still serving with His Majesty's Forces.

The proceedings then terminated.

Gas-Jet Heaters and Ventilation.—At an inquiry before the Bristol City Coroner into the deaths of two sisters, it was stated that the bedroom in which they were found dead had been heated by an appliance fitted on to the ordinary gas-jet; and both door and window had been closed. The doctor said death was due to asphyxiation from carbonic acid gas, and was caused by the two people and the gas consuming the oxygen in the room, in which there was no ventilation. The father said the heating burner, which was in use last winter, was only a small one; and they had never had any trouble with it. The Jury's verdict was in accordance with the medical evidence.

A Lecture on Refractories.—On the 9th inst., a lecture on "Fuel Economy" was to have been delivered at a meeting of the West of Scotland Iron and Steel Institute, in Glasgow, by Prof. William A. Bone; but an intimation was made by Mr. Herbert Beard (the President) that, owing to indisposition, Dr. Bone was unable to fulfil his engagement. In expressing his regret at Dr. Bone's illness, Mr. Beard said the large attendance indicated the interest that was being taken in fuel economy. Manufacturers—especially of iron and steel—were considering the problem with a view to really effective action being taken to prevent any waste of fuel. Mr. Beard then introduced Dr. J. W. Mellor, of Stoke-on-Trent, who, he said, had come on short notice to act as a substitute. Dr. Mellor delivered an interesting lecture on "Refractories."

COMMERCIAL GAS COMPANY.

The Ordinary Half-Yearly Meeting of the Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. W. G. BRADSHAW in the chair.

The SECRETARY (Mr. F. J. Bradfield) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

A WARNING FULFILLED.

The CHAIRMAN, in moving the adoption of the report and accounts, said: Gentlemen, may I remind you that the last word I addressed to you when we had the pleasure of meeting you in August of last year was one of warning that we must not expect that the results of the half year ending in December would be as satisfactory as those of the first half of the year. I was not attempting at the time to enter into the realms of prophecy or speculation. I was speaking of ascertained facts well known to us. In consequence, our expectation has happened; and the accounts which we are submitting to-day do not afford such good results as those that we presented to you in August last. But I think that, in the circumstances under which we have been working, you will be satisfied that the results are as good as they are, and you will be glad that the Company has stood the strain and stress of war conditions so well. I suppose it is the experience of everyone of us, both in our private and business concerns, that troubles and difficulties have come upon us owing to the war; and the Company has been no exception to the rule. Difficulties have crowded upon us not in ones or twos but in troops. When I mention to you large increases in the prices of our raw materials, increased wages, the payment to our employees of a war bonus, increased demands for gas, that supplies of coal have been restricted, that transport has been sometimes almost impossible, and when I add to these difficulties shortage of staff, you will understand our work has been anxious and trying. As I look back upon the half year, I can only congratulate myself and you that the Company is as sound and as strong as it was at the beginning of the war.

ILLNESS AND RETURN OF THE CHIEF ENGINEER.

Not the least of our troubles during the half year was the fact that our Chief Engineer and General Manager (Mr. Stanley H. Jones), at a most critical period of the winter, was suddenly struck down by illness, and had to be absent for some weeks. His presence at the meeting affords me the opportunity of saying how pleased we are to see him to-day, and to congratulate him upon his restoration to his usual good health. It also gives me the opportunity of saying that his absence afforded the officers working under him an opportunity of proving their value; and I am happy to mention that they took full advantage of the opportunity. It is only right I should say how very deeply indebted we are to our able Secretary and Accountant (Mr. Bradfield) for the amount of the burden he voluntarily and cheerfully shouldered, and for the splendid work he did while Mr. Jones was away. [Hear, hear.]

A FOUR PER CENT. INCREASE.

I propose to draw your attention to the leading points in the half-year's working; and, in so doing, to give you a brief, but I hope comprehensive, account of our affairs, so that you will be able to understand the accounts which are in your hands. I think the most prominent feature of the half year has been the increased demand for gas; and this in spite, as I may remind you, of the restriction of the shop and public lighting, of the effect on the first three months of the half year of the Summer Time Act, and of the campaign which we undertook, at the instance of the Board of Trade, to induce consumers of gas to exercise economy in its use. We have an increased sale of gas of 4 p.ct., which is rather unusual for our Company; and the greater part of this increase took place during the latter end of the half year. In the first quarter, there was an increase of 2·9 p.ct.; in the second quarter, 5 p.ct. In December, the increase over the corresponding month of 1915 was 9·95 p.ct. If I travel outside the half year, and come to the month of January, the increased output amounted to something like 15 p.ct. This greater demand was due to several causes. It was brought about first by the increased demand for heat and power purposes, and also by the shortage of coal, and the high price charged for it in our district. It was not always convenient to comply with the extra demand for gas when our stocks of coal were running short; but we must be glad that manufacturers and householders are learning the value of gas as a reliable and economical fuel for their purposes. Then another factor that brought about an increased demand is the prosperity of the working classes. They no longer have to look to each penny before putting it in the slot; and, in consequence, the pennies went in more freely than usual. Then we had a good increase in the number of stoves fixed. During the first half of the year, we connected 2700; and during the second half, as many again—giving us an increase of 5422 stoves for the entire year. Then I need not remind you that, during December and on into January, fogs and cold weather were very prevalent. These causes have, of course, a special effect in a working district like ours; and they account for the fact that, while we had an increase of 4 p.ct, the other two Metropolitan gas companies had increases of only something like 1 p.ct.

THE COAL SITUATION AND SOME STATISTICS AND FREIGHTS.

Then the second factor in the half year was the high price of coal. I am very thankful that the price of coal was to some extent kept down by the Price of Coal (Limitation) Act. Certainly, the high price of coal is not due, as many people suppose, to any shortage of coal in the country. I have before me figures taken from the Board of Trade returns, which show that the output of coal has been very little less than it was before the beginning of the war. In 1913—the year before war broke out—the output of coal was 260 million tons; the coal and coke exported was 73½ million tons. In 1914, the output of coal was 265 million tons; and some 59 million tons were exported. In 1915, the output was 253 million tons; and the exported coal amounted to 43 million tons. Last year the output was 256 million tons (or more than in 1915); while the coal exported amounted to only 41 million tons. So you see there was really last year more coal available for use in the country than in the previous year. Of course, we must bear in mind that more coal was required for Navy and Army purposes, and for the manufacture of munitions; but shortage of coal does not account for the very large increase in the cost of it to this Company. It is rather due to the higher cost of transport from the North to our works; and an illustration will make this clear to you. In the last pre-war year ending on June 30, 1914, our coal f.o.b. in the North cost us 13s. 8d. per ton; last half year, coal cost us 16s. 3d. per ton—an increase of 18½ per cent. In 1914, the cost of freight and shipping charges was 3s. 11½d. per ton; while last half year it rose to no less than 9s. 5d. per ton, which is an increase of 138 p.ct. Of course, this increased cost is partly caused by the increased wages we have had to pay the crews of our ships (they have doubled since the commencement of the war), and still more to the delays due to the action of the submarines in the North Sea. Before the war we had four ships, with an aggregate carrying capacity of 3000 tons. They made something like sixty voyages a year; so that they carried about 180,000 tons during a year, which is equivalent to 3500 tons a week. In 1915 we bought an extra steamer of 850 tons capacity; and in 1916 another of 1050 tons. Thus we increased the carrying capacity of our little fleet from 180,000 tons per annum to 294,000 tons, which gave us 5654 tons per week. Notwithstanding this, there comes a startling fact, that during the eight weeks ending on Jan. 26 last, instead of 5654 tons per week, we only received on an average 2891 tons per week. Well, gentlemen, you will not be surprised when I say we found it necessary to buy another ship of 1000 tons. So we have increased the carrying capacity of our fleet, under normal conditions, to 350,000 tons a year. We have had to pay a war price for the new ship, and a very heavy price it is. Weeks passed before we succeeded in buying her; and when we did succeed in getting her, it was a great relief to our minds. Although a very high price was given for the ship, the other boats in our fleet have been written-down in our books to a low figure. And as it is probable that the price of ships will keep up for a considerable time after the war, if then we are able to sell the surplus vessels we no longer need, we hope to make a handsome profit.

THE POSITION OF OIL.

Well, gentlemen, if the price of coal has risen, the price of oil has risen still more; and from the same causes. Illustrating this in the same way as I did coal, I may say that we buy some 10,000 tons of oil (which is 2,630,000 gallons) a year. Before the war, we were giving for it 61s. 3d. per ton; and we were paying 20s. for the freight across the Atlantic. Last half year the cost of the oil was 68s. 10d.—very little more (only 12 p.ct.), while the freight had risen from 20s. to 129s. per ton, which is an increase of 545 p.ct. I fear, if our Navy does not succeed in restricting or stopping the depredations of the U-boats, the cost of freight will increase even more. While on the subject of our ships, may I remind you how much we owe to our merchant seamen, who daily face danger and death in order that they may keep up the supplies which are needed in this country. I am sure they deserve our admiration and respect no less than the brave man who man our Navy and form our Army. The crews of our ships have done their duty nobly and unostentatiously; and I should like to convey to them the thanks of the proprietors and the Directors for the way in which they have helped the Company during the half year. [Hear, hear.] While on this subject, I may tell you that 298 of the Company's employees have enlisted; and 14 have laid down their lives in their country's service (five during the past half year). We mourn the loss of these brave men; we sympathize with their bereaved relatives; and we are thankful that the spirit which inspired our forefathers to build the mighty British Empire still animates their sons to defend it in the face of oppression and tyranny.

GOOD WORKING AND RESIDUALS RESULTS.

Now, gentlemen, the working results of the Company as they are revealed in the accounts (and by "working results" I mean the quantity of gas, coke, tar, and ammonia that are produced) are as good as ever; and this means that they are very good indeed. They are a credit to the engineers of the stations. During Mr. Jones's illness, I had the opportunity of making closer acquaintance with them than I have had before; and this closer acquaintance only gave me greater confidence in their ability and their judgment. The accounts which are before you reveal to the expert eye, even more eloquently than I can tell, the ability and the zeal of our officers. As a consequence of this good work, and of high prices, the residuals—coke, tar, and sulphate of ammonia—brought in the record sum of £88,918, which is £18,742 more than in the corresponding half of 1915, and £36,587 more than in the last pre-war half year. The £88,918 represents no less than 52 p.ct. of the cost of coal and oil. These are very good results; but I am satisfied we can do even better, and we shall do better when we undertake further processes in the working-up of our tar.

THE FINAL FINANCIAL RESULTS.

Now let me summarize the financial results of the half year. The balance of profit £47,484 compares with £72,760 this time last year, or £25,276 less. But when you recollect the cost of coal and oil (and coal and oil cost us no less than £50,938 more than in the corresponding half of 1915), and add to it the increased wages we have been paying, and the terrible prices we are paying for almost everything we use upon the works, I think you will be satisfied that the results are as good as they are. The profit is short of the interest and the statutory dividends by £12,000; and we feel we are justified in recommending you to declare the full statutory dividends, because when they are paid we shall carry forward an undivided balance of profit to the current half year of no less than £75,867.

CALORIFIC VALUE STANDARD.

I have only three other things I want to mention briefly. First of all, we have resolved to apply for the Company's gas to be subject to a calorific standard, instead of as at present an illuminating standard. This change has already been made by many of the leading companies; and it can be effected by an Order of the Board of Trade. So we have

not to apply for an Act of Parliament. It is rendered desirable, of course, by the increased application of gas for heating and power. You are all aware how the use of incandescent mantles for lighting has extended in latter years; and you know the efficiency of the incandescent mantle depends not on the illuminating power of the gas, but on its heating value.

THE WAR LOAN.

The second thing to which I have to call attention is this. Our thoughts and our efforts, I hope, are concentrated to-day on the issue of the new War Loan. You will agree with us that this Company ought to do its "bit." The investment of money is not one of the purposes for which the Company was incorporated; but, as the accounts show, we have a reserve fund and an insurance fund. Financial purists would say that both these funds should be invested outside the business. Our Act of Parliament lays it down that the insurance fund must be invested in Trustee securities; and the reserve fund "may be" invested in such securities. We have followed the Act. Our insurance fund is fully invested; our reserve fund is partly invested. The reserve fund amounts to £42,569. Of this, £11,413 is invested, and £31,156 is not invested. We propose to invest this sum in the new War Loan. I am quite sure in this we shall have the approval of every one present in this room. Our country needs the utmost of everyone of us at this time of crisis. In the words of the Chancellor of the Exchequer, "we have given our sons; we will not withhold ourselves or our possessions."

PROSPECTIVE INCREASE OF PRICE.

What you have seen in the accounts, and what I have said to-day, will have prepared you for the statement that a further increase in the price of gas is no longer to be avoided. We have during the last few days made careful estimate of the receipts and expenditure of the current half year; and some of us (I have to say "some," because the matter has not yet been definitely before the Board) have come to the conclusion that an increase in the price of gas is absolutely necessary. It has not yet been decided when the increase shall take place, nor how much it shall be. But I can give you the assurance that we shall not put the price higher than we are compelled, and that we shall not keep it up one moment longer than is necessary. Our Acts of Parliament and our profit-sharing scheme make the consumers, the stockholders, and the employees partners in the good or the bad fortunes of the Company. We have shared the prosperity of the concern in past years, and have rejoiced in it. Now dark days have come upon us, we shall, I am sure, all bear cheerfully and patiently our part of the burden, looking forward to those better times and that renewed prosperity which we confidently hope are yet in store for us.

The DEPUTY-CHAIRMAN (Mr. H. E. Jones) said he had great pleasure in seconding the resolution. He only wished to add his testimony to that of the Chairman as to the devotion and care with which the staff had discharged their duties throughout the period of unparalleled anxiety. The new and pressing anxiety—the need of raw materials and the difficulty of obtaining them, apart from their expense, had been matters bearing very hardly upon the whole of the staff, and not a little on the Board itself.

The motion was unanimously carried.

THE STATUTORY DIVIDENDS.

On the proposition of the CHAIRMAN, seconded by Sir FREDERICK GREEN, dividends were declared for the past half year at the rates per annum of £4 18s. 8d. p.ct. upon the 4 p.ct. stock, and £4 13s. 4d. p.ct. upon the 3½ p.ct. stock, in both cases less income-tax.

RETIREMENTS AND RE-ELECTIONS.

The DEPUTY-CHAIRMAN moved the re-election of the three retiring Directors.

Sir FREDERICK GREEN seconded the proposition, which was cordially passed.

The CHAIRMAN having thanked the proprietors on behalf of his re-elected colleagues and himself,

Mr. WILLIAM GROVES moved, and Mr. A. DICKSON, JUN., seconded, the re-appointment of the retiring Auditor, Mr. G. W. Ilsley.

The motion was carried.

WELL-MERITED RECOGNITION.

Mr. M'NAUGHT moved a vote of thanks to the Chairman and Directors and to the officers and their staffs, as well as to the workmen, for their ability and efficiency during an exceptionally anxious period. In doing this, he said he would especially like to mention the self-sacrificing devotion of the men of the mercantile marine who were enabling them to supply the public with an essential of life. All engaged in the Company from the Chairman to the lowest worker were serving the country, and serving it well.

Mr. R. S. YOUNGS seconded the motion, which was heartily agreed to.

The CHAIRMAN, in replying for his fellow Directors and himself, said they recognized that it was not a mere formal matter with the proprietors to give them these thanks. It was certainly not a matter that they failed to appreciate. They valued very much the confidence of the proprietors; and he was glad to know that they possessed it. It nerved them when difficulty came; and it heartened them in the face of trouble. He should like to add his testimony to the way in which all the employees, from Mr. Stanley Jones to the youngest recruit (who, by-the-bye, was not a man but a girl), had done their duty during the past half year. He thought it was a matter of very great congratulation to the whole country that the women had filled so admirably and courageously the places of the men called to His Majesty's forces. He only heard one voice throughout the City, that their work was well done; and he found the echo of that in the Commercial Gas Company.

Mr. STANLEY JONES thanked the proprietors very much on behalf of the engineering and managerial staff for the kind expressions that had been used. He said he felt especially privileged on this occasion to have to reply for the staff, because, as the Chairman had mentioned, he had unfortunately been away part of the half year. But this had supplied the opportunity to prove how excellently he was supported by the staff and the other employees of the Company. They all worked extra hard and well. The Chairman had modestly refrained from mentioning his own services. All through he took more work on himself, for which he (Mr. Jones) was much indebted to him. He was glad to be back to take his part while times were still critical. One other little point he should like to mention. The war had developed, as they all knew, fresh industries in the country which were not before thought of; and they of the Commercial Gas Company were realizing great benefit from this. The proprietors would be glad to know that industries were being built up in their district which were going to live not only during the war but afterwards. Tremendous developments were taking place in the use of gas which were not before contemplated, and which he hoped would bring them a little more profit in the future.

Mr. BRADFIELD also responded on behalf of the clerical staff and himself. He said he should like to refer to the kind remarks the Chairman had made with reference to himself for the work done during the absence of Mr. Jones. He must say that any assistance he had rendered in that time would have been absolutely impossible without the co-operation and loyal help of the three engineers of the works, and also of Mr. Jones's and his own staff. They all did everything they possibly could to keep matters going smoothly; and he realized they did this not only in the interests of the Company, but out of sympathy for their chief in his very serious illness.

TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY.

A Temporary Reverse Explained.

The Half-Yearly Ordinary General Meeting was held last Saturday, at the Chief Offices, No. 639, High Road, Tottenham—the Right Hon. Sir DANIEL F. GODDARD, M.P., in the chair.

The SECRETARY (Mr. E. J. K. Fussell) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

THE STRAIN OF WAR.

The CHAIRMAN, in proposing that the report of the Directors and the statement of accounts be adopted, said he supposed if, in ordinary circumstances, he had to submit to the proprietors the report which they had before them that day, he would be in a state of trembling anxiety. But he did not feel so at all on this occasion, because he believed that, in the remarks he had to make, he could explain the whole position. The explanation of the report was contained in one sentence—"We are at war." This was what accounted for every thing which would be otherwise difficult to explain, and which had made their hitherto prosperous undertaking look for a moment under a cloud. He supposed it would be a mere truism to say that all of them—everyone there—were feeling the effects of the war, some in one way and some in another. He knew there were several in the room who were personally feeling strain and anxiety from the knowledge that those who were dear to them, or those in whom they were interested, were in peril and in danger. Then they were all suffering because the prices of everything they required had gone up in a most extraordinary way—all due to the war. Then further than this, almost every newspaper that came out contained some fresh restrictions, which were new to them as Englishmen and Englishwomen, as to what, and how much, food they might eat and so forth, and which they could never have realized except for the fact that this dreadful war was upon them, and was accountable for it all. So they were all personally feeling it, and all gas companies were feeling it very terribly—some more than others.

WHEN SUCCESS IS A DIFFICULTY—DELAYED CONTRACTS FOR NEW WORKS.

Unfortunately, the Company were perhaps feeling the strain of the war more than almost any other. He did not know whether he could go beyond that, but at any rate he thought he might say that. And, further, that it was largely on account of the growing—the constantly growing—success of the Company, which had always made it difficult to keep pace with the progress they were making. At the end of 1913, before even the war was dreamed of in most people's minds, the Directors saw there was the necessity for largely increasing their productive plant. Seeing this, they at once had their Engineer (Mr. A. E. Broadberry) prepare plans and estimates; and they proceeded to issue the contracts for the purpose of erecting a completely new section of works—gasholder, retort-house, and purifiers—all on the newest and best models. They had entered into contracts for all the work just at the time when the war broke out; but the war had prevented any of the contracts being finished. The Directors could not help it; they had no power in the matter. The contractors always fell back upon the reason that they could not get the material, or that they were not allowed to use it. Therefore, there had been delay and delay, and trouble all through. This was what had landed them in their present difficulty. Their estimate was in 1913 that their present plant would have enabled them to pull through the winter of 1914; and that, by the end of that time, the new plant would have been completed; and that, before the winter of 1915, they would have had the advantage of it all. They had pursued this. They had spent something like £200,000 upon these new works; but although they had spent the money, they had not, through the causes mentioned, had one penny of benefit from it. This was a serious matter for the undertaking, as the proprietors would at once see, because, while they had not had the opportunity of earning from this expenditure, they had had to pay the bankers who had kindly lent them the money to carry out the works. So on both sides they had been hit. The effect of this was, as the proprietors would easily see, they had a lot of capital locked-up in unfinished plant, and for the moment it made the capital account per million cubic feet of gas produced much higher than it had been for many years past,

and which it was the pride of their late Chairman (Sir Corbet Woodall) to have reduced to so low a point as it stood at. The proprietors need not think the Directors had lain down carelessly or indifferently under these difficulties. They had pestered the different War Departments to hurry up, and give them the certificates to enable them to carry on the work. They had implored their contractors—not exactly on their knees, but by the most urgent correspondence they could adopt. It had all been in vain. Now to-day—nearly three years since they commenced the work—it was still uncompleted; and he was sorry to say—it was no use hiding the fact from the proprietors—he did not see how they were going to get any benefit from the expenditure of the money during the current half year. It was a sad tale to tell. But it was the plain, simple history, and he must tell it in the plainest way.

THE EFFECTS OF THE DELAY.

This difficulty of getting their new plant acted in many ways, and it reacted in different ways. This was one of the ways the proprietors would easily understand. It had obliged them during the last two winters—1915 and 1916—to work every single retort they had in their possession. Even this winter, pressed as they had been by the demands for gas, they had had to bring into use the old works at Ponders End, which were practically considered to have done their work, and only waited to be pulled down and reconstructed. But they were so pressed for want of gas that they had had to use these old works, and use them not at a profit, but simply in order to supply their customers. The proprietors would, he was sure, readily understand that good results were not obtainable under such conditions as he had named.

LARGE DEMANDS FOR GAS AND SHORTAGE OF LABOUR.

Then to add to their difficulties, while the general consumption had not increased, there had been days in these times of winter when the demand for gas had been prodigious—far beyond anything they had known before. During the winter they had more than once passed all records in the output of gas. Even this they would have got over, if they could have obtained the appliances which would have enabled them to measure the pressure of gas in the districts of which they had control. But the war had prevented them getting the appliances which had been on order. They realized they would want them. They had known there were times—especially the unfortunate dinner hour on Sunday, when everybody wanted gas for cooking the Sunday dinner—when the strain on the works was tremendous. But they could not increase the pressure without the necessary apparatus. However, they could not get anything from the contractors in these days. They simply said: "The War Office must come first;" and the proprietors and himself as loyal men recognized that the War Office had to come first in all these things. This was not the only difficulty from which they had suffered. There had been great difficulties, as they might imagine, in regard to labour—not that their men had been unhappy or discontented. On the whole, he might say that their men had been extraordinarily loyal to them in these adverse circumstances. But there were munition works, small arms factories, and other similar places which must have men; and they were willing to give higher wages than the Company could afford to pay. This had been a temptation to their men to go away. Some of their best men were fighting in the ranks; and others had had to go to munition works. The result was the Company had been badly short of labour.

COAL DELIVERIES AND INFERIOR QUALITY, AND THE EFFECTS.

Then, of course, there had been the coal difficulty—the difficulty of getting coal. And when they had bought the coal, there was the difficulty of obtaining delivery. When delivered, it was of such a quality that some of it was not possible to use with advantage. In this, a gas company was awkwardly placed. It was very easy to say: "Why did not the manager think of this before, and why did he not see that proper coal was delivered?" When a man was pushed to do things, when upon him rested the responsibility of keeping up the supply of gas, and when he saw the store of coal getting smaller and smaller, he had to take anything he was offered, in order to maintain the supply. The result was they had had inferior coal with which to work. Inferior coal had a double effect. It interfered with the make of gas; and it interfered with the quality of the coke. The proprietors would scarcely realize this. But he should like to explain it, because he wanted to satisfy them as to the reality of their difficulties. Take, as an example, the inferiority of the coke due to the poorer quality of the coal. They had to use a large quantity of coke in their own business—under the retorts, in the carburetted water-gas plant, and under the steam-boilers. When they had to use inferior coke, they had to consume more. He had not the slightest hesitation in saying that it had cost the Company 4000 tons more coke during the half year than they would have used had the coke been of the high quality which they usually made. The 4000 tons extra coke, if they had not had to use it, could have been sold; and it would have added considerably to the amount of revenue. Then there was another trouble due to the contracts for plant not being completed on account of the war. While every ounce of their coal-gas making power had been employed, they had had to make more carburetted water gas than they would otherwise have liked to do. Carburetted water gas was all very well in normal times, when they used to pay 2¼d. per gallon for oil; it was a very different thing to-day when they had to pay 10⅜d. This was a very real difficulty; and they had been obliged to use this dear oil in order to maintain the quantity of gas demanded of them. And mark this! They had their own customers to think of; and the Directors were very glad they had been so patient with the Company in these times of strain. But there was a great deal more to be done beside the supply of the ordinary customers. There were large munition factories in the district, busy night and day turning out munitions of war. These factories were using gas in large quantities, and the Company had to supply them. So it would be seen that, in every department of the Company's work, they had been hampered by the war.

CAPITAL EXPENDITURE AND CAPITAL RAISING.

Passing to the accounts, and taking first the capital. After allowing for depreciation, they had expended £43,819. Now they had overspent their capital account by a very large amount. In the ordinary course of things, they would have put stock on the market, and it would have been taken up at a premium, which would have reduced the interest on it. In these war times, they could not raise capital. It would not have been good policy for the Directors to have issued permanent stock at the rates it would command at present, and to have permanently laid upon the undertaking the burden of a high rate of interest. Fortunately, they had very well disposed bankers to help them; and he ought to take this opportunity of saying that the National Provincial Bank, who had been their bankers throughout, had been very good friends to the Company in these times of need. They had given the Directors every possible assistance to enable them to tide over the difficulty. The Board would very much like to issue the terminable mortgages to the raising of which they had obtained the assent of the proprietors. But how could they push these mortgages in the market when the Government were pushing its War Loan, and asking for every possible penny to be spared for it? It would have been an unpatriotic act to have done it. The time would come when they could adjust the position; but that time was not yet.

EXPLANATIONS AS TO REVENUE EXPENDITURE AND INCOME.

Turning to the revenue account, it showed an increased expenditure of over £21,203. Coal, oil, and coke used in the manufacture of gas accounted for £30,700; and wages for upwards of £4060. There was more than £34,700 increase on these four items alone over the corresponding half of 1915. It was true that the item of repairs and maintenance of works was considerably less. This was always a variable amount. It depended on how many retorts they had to repair during the period; and during the past half year they had not had the materials and labour, and so they were not able to spend the money for this purpose which in normal times they would have expended. At the same time, he wished the proprietors to understand that, although they were working their plant at its highest capacity, and were in fact over-working it, he thought he might say it was in thoroughly good condition. They had saved considerably under the head of distribution—£8849. This, again, might be said to be accounted for entirely because they had not been able to get material and labour, and so had not been in a position to deal with the mains and services as in olden times. The lighting and repairing of public lamps (£171, compared with £1748) must be taken in conjunction with the receipts for public lighting, which showed a reduction of about £4500. This told a plain story. It showed how the war had put out most of their public lamps, and, having been put out, they had not been maintained. Therefore the cost had been largely reduced. In regard to rates (£6022, against £10,734), he must ask the proprietors to read the note attached to the 1915 report regarding income-tax. It stated that the £10,734 included £3936 income-tax. Acting in accordance with the latest methods, they had put income-tax to net revenue account; and therefore it made the item of rates appear less than it really was. Co-partnership showed a very serious reduction—£970, against £2000. Of all the items in the account, this was the one he mostly regretted. He regretted they should, in a sense, have to aim this blow at their employee co-partners. But when they entered into the co-partnership scheme, the employees were put on the same footing as the ordinary proprietors. When the price of gas was increased, the proprietors lost part of their dividend, and the employees part of their bonus. On the same side of the account, there was a set of three special war items—payments to dependants of men on war service, war bonus on wages, and aircraft insurance—amounting together to £7308. This was a special charge due to the war, which would not occur again when they got back to times of peace. Therefore the Directors had felt this was a perfectly just sum to charge against insurance fund, which was a fund raised to meet exceptional expenditure in any special year. The Board had taken this amount out of the insurance fund, and had added it to the amount of divisible profit. In connection with these special war charges, the proprietors would be interested to know that 290 of their men were serving under the Colours; and he was sorry to have to say that, in addition, 23 had paid the supreme penalty of their loyalty and patriotism, and had laid down their lives for their country. Turning to the other side of the account, the receipts for gas had gone up. But it would be remembered that the price of gas was raised by 5d. at the beginning of last half year; and this accounted in the main for the increase. The total was £149,696, against £134,122. On the face, the residuals looked fairly satisfactory. There was an increase of £4144 on residuals. He was not satisfied with this, nor were any of the Directors. In the first place, as he had explained, coke would have been worth a great deal more if the coal had been of better quality. Then the sulphate of ammonia had not been at all a satisfactory item. They were giving every attention to this; and they hoped very shortly to be able to show a very much better result. The gross profit earned was £18,225, which compared with £20,530, after adjusting the charge for income-tax for the corresponding half year.

THE ELECTRICITY ACCOUNT.

As to the electricity account, this was only a small business yet, but still it was a small profitable business. Some 178 meters were in use for electric lighting, and 30 motors, giving 135 H.P. The profit had slightly increased. If the business was going slowly, it was going surely; and they hoped it was going to last.

UNACCOUNTED-FOR GAS.

One interesting item was the difference between the amount of gas made and the amount paid for—that was to say, the unaccounted-for gas. It was high; there was no denying it. They did not blink the fact that it was more than it ought to be. On the half year, it was something like 11½ p.ct.; but if they took it on the whole year, it was not more than 8 p.ct. What did this mean? Why was it less in one half year than in another? It was a simple explanation. In the winter half year there was a great deal more money locked up in the prepayment meters than in the summer half year, when the gas consumed was much smaller day by day, and there was much less money in the boxes than in the winter half. If the money could have been collected, there would not have been so much unaccounted-for gas. There were many other circumstances that had increased the item. There was a tendency in this very cold weather for consumers to say: "I must have a gas-stove here, or an extra burner there," and so forth. They got what they wanted as soon as it was possible to attend to them. In this

way so many more appliances were put upon the meters they had; and he (the Chairman) thought that part of the unaccounted-for gas might be due to the fact that there had been more strain put upon the meters than they were originally intended to bear. He thought there was another and simple reason for the unaccounted-for gas. They knew perfectly well that in these days an enormous increase of motor traffic passed over the streets; and this had a great effect on the mains and services, especially as they were not always quite new. Directly a little escape became noticeable in normal times, it received attention. In these days of stress and strain, the Company had not the men to do this; and so the escapes could not be attended to so promptly. This explained some of the extra loss of gas.

THE AVAILABLE AMOUNT OF PROFIT SHORT OF THE STATUTORY DIVIDEND.

The available balance for dividend purposes was £6428. To this they added the £7308, which gave them £13,736, after deducting interest on debenture stock and loans. The full statutory dividend they were, at the present price of gas, allowed to pay on the ordinary stock would amount to £18,147. They had only £13,736 with which to pay it; and they had nothing to carry forward. It was clear they could not pay the full statutory dividends. The only way in which they could pay them would be by withdrawing from the reserve fund, which was not a wise policy; and he thought the proprietors would commend the Directors for not adopting this policy. Therefore the Directors in their report did not recommend the payment of the full statutory dividends. They were sorry to have to do this; but they wished to be honest and true. They could not pay them; and for a time the proprietors must say they were paying, by receiving less dividend, a share for the war in which the country was involved. The payment of the dividends recommended would amount to £13,054, and leave £682 to be carried forward.

A FURTHER INCREASE IN PRICE.

When the proprietors looked at these figures, he thought they would see that one result was inevitable. They were not paying their way; and they must have another increase in the price of gas. The Directors were exceedingly loth to have to do this. Personally he felt this very strongly, especially in regard to the large number of prepayment consumers, many of whom felt any little increase in the cost of living. But he did not see there was any other conclusion possible; and the Directors were thus obliged to give notice that, at the earliest moment they would again raise the price of gas. But it was a reassuring thing that he believed they would even then be selling gas at a lower rate than a good many of the companies in the London area.

AS TO THE FUTURE.

Regarding the future. The last time he addressed the proprietors he said that the business of prophet was a very dangerous thing. But he did make one prophecy at the meeting. He said that they had certainly in front of them a very bad and difficult winter. This prophecy was a very true one. They had never had so much difficulty, and had never put so much strain upon their Engineer and General Manager (Mr. A. E. Broadberry) and his staff, as they had during this winter, and especially during the last three weeks, while frost had obtained and the demand for gas had been extreme. If they had not satisfied everyone, they had had to throw it back upon the war. As to the future, he was generally an optimistic man himself. He liked to look on the bright side of everything; but he did not wish to raise the hopes of the proprietors too much. He did not think that the current half year the cloud would be lifted under which they were at present living. This seemed impossible. With every effort, they could not see their way to get the new section of their works into action before the end of the half year. But they did hope very much that, in the course of the year, they would get it into perfect order, and, when they arrived at the strain of another winter, even if the troubles of the war were not done away with, they would be able to better cope with the work. Of course, the proprietors would understand that the same difficulties confronted the Company this half year as in the past six months. In regard to coal and oil, the latter had been most difficult to get. Just recently they had had barges of oil frozen in the canal; and they had not been able to get at them without great trouble, and this had added to their work. He could say this with some confidence, that, if the new section of works could be brought into operation by the end of the half year, it would immensely help their work next winter; and he did hope, when they met a year hence (he dared not put it earlier than this), that the present difficulties would have been completely overcome, and that their prospects would then be much more happy and much more normal.

Mr. H. D. ELLIS, in seconding, remarked that no words of his could possibly add point or worth to the very able statement the Chairman had, with such clearness and frankness, submitted on the affairs and prospects of the Company.

Mr. MICHELL hoped that the relatives of the Company's men who had fallen in the service of the country would be made acquainted with the fact that the proprietors deeply sympathized with them. At the same time, they were very thankful that the number of their men who had made the supreme sacrifice was as low as 7 per cent., which was very small in this war. As to the business of the half year, the reduction of dividend in the case of this Company was exceptionally severe. Comparing the proportion of income from residuals with the gross cost of coal in the case of the Gas Light and Coke Company, he commented on the fact that it was much smaller in the case of the Tottenham Company. He believed, too, the South Metropolitan Company did even better. He also inquired whether the sale of gas would not this year be appreciably affected by the Summer Time Act coming into force earlier than it did last year. With regard to the deduction of income-tax from the dividends, it was now very heavy; and he suggested that the Directors should specially call the attention of the proprietors to the fact that they were entitled to a return of part of the income-tax in cases where the total income did not exceed £2000 a year, while those whose income was not £120 a year were entitled to a return of the whole of the tax. He sympathized with the Directors upon the loss of some £5000 interest upon unproductive capital, which was unproductive owing to the war. The Company had always been an admirably managed one, and had conferred great benefits not only upon the proprietors but upon the district; and the proprietors believed the concern would be still more progressive in the future.

The CHAIRMAN, replying to Mr. F. Durlington, said the standard price was 3s. 8d.; and this accounted for the difference between the standard dividend and the one to which they would have been entitled had they earned the necessary amount of profit.

Mr. J. R. RIDDELL said that £41,456 had been expended on new buildings and plant, compared with £13,000 in the corresponding half year. He thought, in the circumstances of the times, this larger expenditure required some justification. The sum charged as depreciation of plant, £892, seemed ridiculously small. As to the balance-sheet, it seemed there was £61,551 owing for stores, &c., against £49,071 in the corresponding half year. The £61,551 appeared to be a large amount. He also suggested that the small shareholders and co-partners should have representation on the Board. As to the complaints that had been made by consumers, he asserted that there was real ground for dissatisfaction regarding the pressure; and he asked whether it was true there was to be a 25 per cent. increase in the rental for stoves and fittings.

Mr. W. BARRAGWANATH inquired whether there was any prospect of an application to Parliament to readjust the sliding-scale of price and dividend, in view of the increased cost of materials and labour, and the increased interest now being paid for money. There would be a permanent loss to the proprietors unless some readjustment was made in the sliding-scale.

The CHAIRMAN thanked Mr. Michell for his kind observations, and said the Secretary would communicate, as far as possibie, with the relatives of the Company's men who had fallen in the war, apprising them of the feeling of sympathy of the proprietors. Regarding residuals, they could not compare their Company with the Gas Light and Coke Company, who had large products works of their own for working-up residuals. Companies on a comparatively small scale could not do this. Nor could they compare their working with the South Metropolitan Company, who raised their price of gas long before the Tottenham Company. Further, the South Metropolitan Company only made coal gas, and so had not to contend with the war difficulties in regard to oil for making carburetted water gas. He welcomed the remarks of Mr. Michell regarding reclaiming of income-tax; and it was a very proper reminder. As to the Summer Time Act, so far as their Company were concerned, they would welcome it if it commenced next day. In present circumstances, if anything would reduce the consumption of gas, it would be for the good of the Company. As to Mr. Riddell's remarks, the deduction of depreciation on works and plant was all they were allowed by the Inland Revenue Commissioners. Respecting the increase in the amount owing to sundry tradesmen and others, £10,000 of this was due to the larger stock of coal, which was some 8000 tons more. He (the Chairman) had already explained that the trouble regarding pressure was attributable to the fact that they could not get the necessary apparatus for raising it when the demand for gas necessitated; and they were now told it would be the middle of April before they could obtain it. It was true they had given notice of a 25 p.ct. increase in rentals for stoves, &c., on hire. This was due to the increased costs that the Company had to pay for these things and for their maintenance. Those people who objected to paying the additional hire could, of course, avoid it by purchasing the stoves and fittings themselves. He was afraid that a readjustment of the sliding-scale was impossible. It was too late to introduce a measure this session; and as to what might be done eventually he could not say.

Mr. W. G. BROWN said he was brought into contact with many consumers who complained of the pressure and quality of the gas; and he thought if a short statement could be distributed among them explaining the position as the Chairman had described it that day, it would do good.

The CHAIRMAN said the Company wanted to avoid complaints as much as possible. Where they could not avoid them, they would try to placate the customers as much as possible.

The motion was unanimously carried.

THE DIVIDENDS.

On the motion of the DEPUTY-CHAIRMAN (Mr. Henry Woodall), seconded by Mr. HENRY BAILEY, dividends were declared at the rates per annum of 5 p.ct. on the preference stock, 5 p.c. on the "A" stock, and 3½ p.ct. on the "B" stock, all less income-tax.

THE NEW AUDITOR.

Proposed by Mr. A. D. WHEATLEY, and seconded by Mr. RIDDELL, Mr. William Cash, F.C.A., was appointed, at a remuneration of £100 per annum, one of the Auditors in the place of the late Mr. James L. Chapman, to whose services the CHAIRMAN made fitting reference.

Mr. CASH heartily thanked the proprietors for their confidence.

A VOTE OF THANKS.

Moved by Mr. H. C. WELD, and seconded by Mr. G. M. WILLIAMS, a cordial vote of thanks was passed to the Chairman and Directors, the officers, their staffs, and the workmen for their devotion to duty during a period of exceptional difficulty.

The CHAIRMAN, having responded for the Board, said, although the Company were under a cloud just now, before long it would pass away, and they would get into happier times.

Mr. A. E. BROADBERRY, on behalf of the officers, staffs, and employees generally, also thanked the proprietors. He remarked that the work at the present time was undoubtedly very difficult. They had had all they could do to manage to carry on; and their difficulties had been made a great deal worse, as the Chairman had said, by the fact that they were compelled to work their carburetted water-gas plant, which was unprofitable at the present time. They would, in fact, be much better without it. In addition to the difficulties of their ordinary work, they had others, but he would only mention one of them. Time after time during the past half year they were called out suddenly in the night by the Field Marshal's orders to take action. If the call came that

night, he was faced with the position as to whether gasmaking should be shut-down altogether. If he determined that it should be, the gas supply would fail altogether, because they were so short of stock. If not, then the men would make a target for themselves by the light given off from the works. These were the conditions under which they had to carry on their work at the present time; but they were encouraged by the knowledge that their labour was appreciated by the proprietors.

NEWCASTLE AND GATESHEAD GAS COMPANY.

The Annual Meeting of the Company was held on Tuesday last, at the Offices, Grainger Street West, Newcastle-on-Tyne—Sir W. H. STEPHENSON (the Chairman) presiding.

The CHAIRMAN, in moving the adoption of the report and accounts [*ante*, p. 307], said the revenue from all sources during the past year had been £664,023, against £579,481 in the previous year, showing an increase of £84,542. The expenditure had been £540,745, compared with £454,937, an increase of £85,808, and a decrease in the gross profits of £1265. The gross profit for the year had been £123,279; and, with the sum brought forward, the amount at the disposal of the Directors was £135,227. Interest on debenture stock and other loans amounted to £31,311; and, after paying £44,866 as interim dividend in August, the sum of £59,050 was available. Out of this the Directors recommended the payment of final dividends on the preference and ordinary shares at the rate of 4 and 4¼ p.ct. respectively, which left a balance of £14,184 to be carried forward—an increase of £2761 over the previous year's balance. Gas had yielded £385,840, an increase of £18,462; and the quantity sold was 4,016,000,000 c.ft., an increase of 220,000,000 c.ft. This was 5¾ p.ct. more than in the previous year, and was another record as regarded sales of gas, which had taxed the manufacturing plant to the full during the present winter. The decreased revenue from public lighting, compared with 1914, was £19 750, due, of course, to lighting restrictions brought about by the war. The number of consumers had increased by 1207, making a total of 125 734 at the end of the year. There was an increase in the rental of meters, lamps, stoves &c., of £958; and residuals, which yielded £216,000, showed an increase of £65,043. Coke had produced £51,000 more than in 1915; but, owing to shipping difficulties, its disposal had caused great anxiety. The financial results from tar were still short, by reason of the very restricted outlet for pitch. The contract for the sale and purchase of tar which the Company had had in recent years had expired; and the Directors contemplated the erection of distillation plant at St. Anthony's, which they believed would produce better financial results. The increase in the price of coals during 1916, compared with 1915, was over £75,000. There had, however, been a reduction in the cost of gas purification to the extent of £3100. The sum of £21,000 had been paid to workmen as war bonuses, and £13,300 in allowances to dependants of the staff and workmen serving with the forces. It was with great reluctance that the Directors had had to increase the price of gas by 2d. per 1000 c.ft., due to increased cost of wages, coals, and other things. Since the last increase in the price of gas, it had been necessary to give new war bonuses to the employees. These bonuses, in 1917, would cost £30,000. With regard to coal, in June, 1915, the price was 11s. 7d. per ton; in June, 1916, 12s. 11d.—mostly purchased before the passing of the Price of Coal Limitation Act, 1915. For the twelve months ended June this year, the price was 15s. 7d. Thus, between these periods the increase was 4s. per ton; and the Directors could not expect to purchase for the remainder of 1917 at less than limitation price. Therefore, on the quantity of coal required this year, the 4s. per ton represented £77,000. Oil for gas making had considerably increased in cost. Under the sliding-scale, the shareholder was required to suffer along with the consumer in the increased price of gas, as, for each 1d, increase in the price of gas, the shareholder had to take 2s. 6d. p.ct. less dividend. Of the Company's staff, 581 had joined the Colours; and 38 men had been killed, while six were prisoners of war. Mr. Thomas Waddom, the Secretary, was in his fiftieth year of service with the Company; and he (the Chairman) offered him his congratulations. He also paid a tribute to the way in which the whole of the staff had worked during the year.

Sir WALTER PLUMMER seconded the motion, which was unanimously adopted.

The dividends recommended were then declared; and the Chairman was thanked for his services.

Gas Explosion in Cookstown.—A serious explosion occurred last week in a shop at Cookstown (co. Tyrone); a fire afterwards breaking out, which did great damage. The Gas Company's officials, on investigation, found that the severe frost had caused a rent in the gas-main opposite the shop.

Double Gas Suffocation Case.—An elderly couple, brother and sister, were found suffocated at Ingrow; and at the subsequent inquest (when the Jury returned a verdict of "Accidentally suffocated by an escape of coal gas") it was stated that there was a "mushroom" heater on the gas-burner, which had been left alight, but had gone out. The opinion was expressed that it was dangerous to leave a small gas-light at night, when there was no one to watch it.

Kirkby-in-Ashfield Gas Supply.—Proceedings at the last meeting of the Kirkby-in-Ashfield District Council afforded an illustration of the fact, in relation to gas supply, that there are some members of public bodies who are not unmindful of the difficulties under which engineers are at present working. A proposal for granting a small bonus to Mr. G. G. M. Gribble (who is in charge of the undertaking) was met by an amendment that no such recognition was warranted, as the works were not paying. But insuperable difficulties as to enhanced cost of materials and restricted consumption through lighting restrictions were pointed out, and the bonus was voted—only the mover and the seconder supporting the amendment. The testimony was forthcoming that no man had served the Council better than the Resident Engineer.

SHEFFIELD UNITED GAS LIGHT COMPANY.

Sales Up Practically 8 P.Ct.

A largely increased business during 1916 is revealed by the report of the Directors, which will be submitted to the proprietors at the meeting on the 12th prox.

The total quantity of gas sold during the twelve months to Dec. 31 was 5,343,934,000 c.ft., being an increase of 394,524,000 c.ft., or 7·97 p.ct. over 1915. The usual interim dividend of 5 p.ct. was paid for the half year ended June 30. After paying the dividend for the six months to Dec. 31, there will be a balance of £21,224 to be added to the amount previously carried forward. Owing to the obligation the Company are under to provide toluol and benzol for the Government, and to their being unable to obtain efficient labour, the Directors are experiencing great difficulty in meeting the present heavy demand for gas; and they take this opportunity of thanking their customers for the forbearance they have shown in the trying conditions which have been brought about by the war. The average price at which gas was sold during the past twelve months was 1s. 6·79d. per 1000 c.ft.

The accounts accompanying the report show that the revenue from the sale of gas was £414,152; rental of meters and stoves, £24,127; and residual products, £278,519—miscellaneous items bringing up the total to £722,970. The following are the principal items of expenditure: Manufacture of gas, £520 514; distribution, £37,380; management, £17,743; rents, rates, and taxes, £29,806—miscellaneous items (including £2268 paid to the families of men who have joined the Army) making up a total of £612,922; leaving £110,048 to be carried to the profit and loss account.

A Comparison.

The following comparative figures are quoted from the "Sheffield Daily Telegraph."

	1916.	1915.	1914.	1913.
	£	£	£	£
Cost of manufacture . . .	520,514	380,945	327,170	338,153
Cost of distribution . . .	37,380	38,470	35,878	33,141
Coal bill	397,314	274,712	219,860	—
Gas sold, &c.	438,280	355,681	280,115	277,100
Residuals	278,520	214,722	173,303	201,790

The balance-sheet shows that the net profit for the year was £110,048, to which is added £65,002 brought forward and £3090 interest received from reserve fund investments, giving a total of £178,140. A year ago the net profit was £110,659.

SOUTH SUBURBAN GAS COMPANY.

Half-Yearly Report and Accounts.

The following report of the Directors (signed by the Chairman, Mr. Charles Hunt) will be presented at the half-yearly meeting of proprietors next Friday.

The net revenue account shows that, including the balance of £12,764 brought forward from last half year, and after providing for debenture and other interest, the amount available for dividend is £41,469, out of which the Directors recommend the payment of statutory dividends (less income-tax) as follows: On the 5 p.ct. preference stock, 5 p.ct. per annum; on the 5 p.ct. ordinary stock, £4 16s. 8d. per annum; on the 5 p.ct. West Kent ordinary stock, £4 16s. 8d. per annum—leaving to be carried forward to next half year the sum of £13,681.

The sales of gas have increased by 6·13 p.ct., and the number of consumers by 1548. Gas fires and cookers continue to be in great request; and difficulty has been experienced in keeping pace with the orders for them, owing to scarcity of both labour and materials. The total number of heating appliances of all kinds now on hire is 74,867, averaging nearly 106 per 100 consumers.

Coke has sold well almost throughout the half year; and but for lack of means of transport, there would now be but little in stock. The home consumption of sulphate of ammonia has shown steady improvement. Tar remains the only unsatisfactory feature in the residuals accounts.

Application has been made to the Board of Trade under the Gas (Standard of Calorific Power) Act, 1916, for an Order abolishing the illuminating power standard which still governs about one-fourth of the Company's gas supply, and the substituting for it of the calorific power standard which was fixed by Parliament in 1912 for the other three-fourths of such supply.

There are now 342 of the Company's employees serving with the Colours; and resort to female labour has become increasingly necessary. Already 105 women are employed in various capacities on the works and district, in addition to 33 who are engaged in clerical work.

The accounts accompanying the report show that the total capital expenditure at the close of the half year (including the nominal amount added by conversion) was £1,409,278, or £22,573 more than the receipts—viz., £1,386,705, inclusive of the premium capital. A sum of £8622 was expended on capital account in the half year. The revenue from the sale of gas was £167,706; the rental of meters, stoves, and fittings produced £19,739; sales of residuals, £61,320; and the total receipts were £249,172. The following were the principal items of expenditure: Gas manufacture £143,404; distribution, £38,100; management, £8156; rent, rates, and taxes, £11,145; and miscellaneous items bringing up the total to £213,873. Among the last-named items is an amount of £1100 charged on account of the co-partnership scheme, and another of £9043 for war fund bonus and allowances. The balance carried to the net revenue account amounts to £35,298, and there is available for dividend £41,469.

The statements as to working show that, under the supervision of

Mr. S. Y. Shoubridge, the Engineer, 78,851 tons of coal were carbonized and 415,293 gallons of oil used in the half year. The quantity of gas made was 1,228,095,000 c.ft. (240,523,000 c.ft. of oil gas), of which 1,090,802,400 c.ft. were sold and 1,101,986,500 c.ft. accounted for. The residuals made were: Coke 49,285 tons; breeze, 19,073 yards; tar, 843,180 gallons—the make of sulphate of ammonia being 839 tons.

GAS CONSUMPTION AT PLYMOUTH.

Economy Necessary.

Consumers of gas in the area supplied by the Plymouth and Stonehouse Gas Company have been warned that they must exercise economy. The need of economy as a patriotic duty is being preached all round; but this appeal to users of gas is based on reasons which directly concern the Company, and endanger the maintenance of supplies at the normal and increasing rate of consumption.

The fact is that the Plymouth Gas Company, like other undertakings situated far from the coalfields, are experiencing difficulty in obtaining adequate quantities of coal. In ordinary times, Plymouth gets practically the whole of its coal by sea. The Gas Company have for years had contracts with Durham owners for coal, and with shipowners for its conveyance to the port, on terms which have helped to make Plymouth remarkable among South-Western towns for the cheapness of its gas. Now, however, ships are not available, either for the Gas Company or for anyone else; and all the coal that is required in Plymouth—at all events, all that needed by the Gas Company, has to be conveyed by rail. This not only adds enormously to the cost, but in the present congested state of the railways makes the delivery very uncertain.

It was stated at the annual meeting of the Company last year that 200 wagons would be needed for the conveyance of coal to Plymouth; and that the journey to and fro might, in the then congested state of the traffic, be reckoned at anything up to six weeks. Since then railway conditions have not improved, but, on the contrary, have become worse; and this fact, coupled with the extra demand for gas for heating during the recent spell of severe weather, has given rise to the apprehension that it may not be possible to keep things going. Another element in the situation is that of the supply of oil. From its geographical position, Plymouth is better off than some other large towns in regard to the prospect of obtaining oil from America. Still, the increased activity of enemy submarines makes the supply more doubtful, and adds to the anxiety caused by the irregular deliveries of coal.

Whether the consumers will respond to the appeal for economy remains to be seen. Lighting has, of course, been greatly reduced, and is in most circumstances at a minimum. On the other hand, the use of gas for heating and cooking tends to increase, not only because of the severity of the weather, but because of the scarcity and dearness of coal for domestic use. In this matter, the conditions which affect the Gas Company apply to everyone; so that a reduction in the use of gas may be difficult to practise in many households.

PORTSEA ISLAND GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held at the Offices, Commercial Road, Portsmouth, last Thursday—Mr. R. EDGCOMBE HELLYER (the Chairman) presiding.

The CHAIRMAN, in moving the adoption of the report and accounts [*ante*, p. 314], said that at the previous meeting he had stated that the Directors anticipated the increased price charged to the consumers would not meet the increased cost of production. They had only to refer to the accounts to see that the forecast was justified. Manufacturing, distributing, and management charges cost £15,600 more than in the corresponding half of last year. Coal and oil showed an increase of £21,450, and wages and salaries of £1527—making a total of £22,977; but economies had been effected which showed a saving of £7344. Notwithstanding the increased price of gas, the additional revenue from this source was £6783 only. There was a considerable increase in the receipts from coke; but the sale of other residuals was disappointing. The net result shown by the revenue account was a balance of £9651 only carried to profit and loss account. Months ago the Directors had anticipated such a reduction in the profits. With the amount brought from the last accounts, however, the profit and loss showed an available balance of £27,430; and they therefore felt justified in recommending the payment of a dividend at the full statutory rates, which, if sanctioned, would leave a balance of £10,356. The total number of consumers on Dec. 31 last was 51,169. The quantity of gas sold was 5·71 p.ct. less than in the corresponding six months. This was mainly attributable to the effect of the Summer Time Act, the early closing of shops, and the temporary discontinuance of 827 street-lamps at the instigation of the military authorities. A further cause was the inability of the Company to manufacture as much gas as usual, owing to the shortage of labour and a consequent reduction of the pressure throughout the district. The limited space at the Flathouse works did not permit of large supplies of coal or oil being maintained there; but ample supplies to meet any shortage in the deliveries during the winter were accumulated at the Hilsea works, and it was thought that the Company would have been able to provide an efficient gas service throughout the winter. The military authorities, however, insisted upon the release of more men for the Army; and the requisite number of other men could not be found to take their places. It had therefore been necessary to make up the shortage with boys and women possessing no knowledge of the duties required of them. Unfortunately, too, the time lost by a considerable number of the employees showed a very large increase indeed. In combination, these circumstances had seriously disorganized the work in all departments, and greatly reduced the standard of efficiency. As a result, it had been impossible to manufacture sufficient gas to meet the demand, which had, of course, been much increased by the prolonged spell of severe weather. Even at present the maintenance of the admittedly unsatisfactory service was causing the management grave anxiety; and strong representations had been made to the Admiralty and the military authorities for the release of men necessary for the Company's needs. Notwithstanding these many and serious difficulties, the Corporation, to whom the circumstances had been fully explained, and who were invited to visit the works and see for themselves the conditions prevailing, decided to take legal proceedings against the Company for supplying gas less pure than that required under the Acts. From the proceedings in Court, it would be seen that, in the opinion of Counsel by whom the Company were represented—a gentleman who specialized in the law relating to the administration of gas undertakings—the impurity, caused by a leaky valve, was unavoidable; and the Company were therefore exempt from penalties. It was established beyond doubt by an eminent authority on gas chemistry—Mr. W. J. A. Butterfield—(1) that the tests imposed upon the Company were more severe than were the tests in London or in other Provincial towns; (2) that the impurity complained of—sulphuretted hydrogen—did not reduce the efficiency of the gas; and (3) that it was not present in sufficient quantity to affect in the least the health of the consumers. All that was proved in Court by the prosecution was that gas had been supplied which, if allowed to escape, but not if burned, caused a disagreeable smell; and for this the Bench imposed a fine on the Company of £15 and £10 costs. Whether, under the circumstances, the Company had been treated by the Corporation or by the Bench in a fair and reasonable manner, the public generally must judge. The Directors had on a previous occasion had to offer their apologies for the serious inconvenience which consumers had undoubtedly experienced through the curtailment of the supply; and they again expressed sincere regret. But it must be clear to everyone that such restrictions were altogether opposed to the Company's interests, and, if for this reason only, they hoped the consumers would appreciate that such a course was only taken in case of absolute necessity. Plant for the recovery of benzol had been installed at the Hilsea works. The Directors would have liked to have erected similar plant at Flathouse; but this was impossible, owing to the absence of the necessary ground space. The Company had applied for an Order substituting a calorific standard of the gas supplied for the illuminating power standard. Over 140 women were now employed on work formerly done by men—including, apart from office duties, meter reading, burner attendance, gas-fitting, meter and stove repairs, coal-wheeling, coke-loading, and work in the purifying department. The exact number of the Company's regular men released for the fighting forces was 298. As to the future, he thought the profits would show an even greater reduction in the current half year, owing to the further increase in the price of gas oil, and possibly of coal. Gas oil under their new contract had reached an average price of 10½d. a gallon, as against an average price of 5½d. during the last half year, and a pre-war price of 2½d. This alone would mean an increase of nearly £15,000 in the expenditure for the half year. There were two courses open—(1) to increase further the price of gas; (2) to meet the deficiency by exhausting the carry-forward, and then resort to the reserves. The Directors came to the conclusion that, as long as there was an alternative, it would not be right or fair to throw the burden upon the present day consumer and shareholder by increasing the price, and so further reducing the dividends; and until the reserves had been considerably entrenched upon, they decided that the price of gas should not be increased. But the financial position would have to be again further considered within the next few months.

The report and accounts having been adopted, a dividend at the full statutory rates was declared; and the meeting terminated with the usual vote of thanks to the Chairman and Directors, the Engineer and General Manager (Mr. J. D. Ashworth), the Secretary (Mr. H. A. Stibbs), and the staff.

GAS FURNACE AND APPLIANCES EXHIBITION IN DUBLIN.

On Wednesday last, the Alliance and Dublin Consumers' Gas Company opened, in Hawkins Street, an interesting exhibition in connection with furnace utilization of gas. The exhibition, which will remain open till March 7, starts a new chapter in the history of industrial progress in Ireland. The furnaces on view (or most of them) deal with the melting of lead, aluminium, and brass, the forging of steel, &c. The Davis Furnace Company, of London, whose plant and appliances form an essential part of the exhibition, are represented by Mr. Walter R. Twigg, their Technical Manager, whose demonstrations of the value of gas in various industries have excited keen interest among visitors. Already many of them have recognized the usefulness of the appliances submitted, expressing appreciation of the displacement of solid fuel by gas on grounds of convenience, cleanliness, labour-saving capacity, reliability, power to increase and improve output per square foot of floor space, and ultimate economy. Members of the Irish Industrial Associations have been among those attracted to Hawkins Street, where expert advice and guidance are given daily from 11 a.m. to 5 p.m.

The opening ceremony was performed by Mr. John Murphy, the Chairman of the Alliance and Dublin Gas Company, who attributed the interest that was being manifested in the exhibition to, in no small measure, the importance which gas had attained, and was attaining, in relation to war activities; for there was, he said, hardly a modern factory dealing with metals in which gas was not now used for one purpose or another.

Extending to about an hour-and-a-half (10 to 11.30 p.m.) last Thursday evening there was a stoppage of the electric current throughout Birkenhead. Parts of the district were plunged into darkness, and the tramway service was brought to a standstill. At the theatres the performances had to be abandoned; and considerable inconvenience was caused, though happily no accidents, as far as can be ascertained, occurred through the mishap.

BRADFORD AND THE CALORIFIC STANDARD.

There was some discussion at the meeting of the Bradford City Council last Tuesday on the subject of the application by the Corporation to the Local Government Board under the Gas (Standard of Calorific Power) Act, 1916. On the presentation of the minutes of the Gas Committee,

Mr. J. LUND opposed the resolution approving a draft of the Order proposed to be issued by the Board. He said that the passing of the Calorific Standard Act originated in the demand of the Ministry of Munitions for certain bye-products. There were no complaints on the part of consumers, who cheerfully submitted to the reduction entailed in the illuminating and heating value of the gas. The gas companies, however, saw in this step the opportunity of continuing beyond the limits of the war the process of recovering a new bye-product, and their representatives were called in to advise the Government authorities; and to anticipate any complaints or prosecutions for penalties in respect of deficient illuminating power, it was desirable to pass an Act superseding illuminating power tests altogether, and introducing instead a low calorific test. The adoption of the Act had been advocated on the part of gas companies as a step in the direction of eventually getting rid of luminous flames altogether, and compelling the adoption of mantles. In his opinion, the Council should be no party to continuing beyond the duration of the war a process which, if indefinitely continued for the purpose of obtaining bye-products, might reduce the market value of gas to such an extent as seriously to jeopardize the value of the municipal gas undertaking. There was no occasion for applying for an Order under the Act.

Alderman HAYHURST, in moving as an amendment that the minute with regard to calorific power should be referred back for reconsideration, said that the Council were entitled to have an explanation of this matter before being called on to pass the minute. He argued that there was no need to take advantage of the Act, because so long as the Government required these bye-products of gas manufacture no one would think of taking action against the Corporation on account of the reduced quality of the gas. If anyone did, he would cut a poor figure. If it required his vote to give up the use of gas, and he was assured that giving up the use of gas was necessary to win the war, he would vote for giving it up. But the Council ought to know what this recommendation meant. Surely there was no need to put on the books of the Council an Act which would be useless after the war, and which might do irreparable damage.

Mr. J. H. BARRACLOUGH (the Chairman of the Committee) said it seemed to be suggested that the Gas Committee had some ulterior motive. He could assure them they had not. The fact was that, since the success of the incandescent mantle, and long before the war, the best gas engineers had contended that the standard of illumination ought to be altered. The old standard of illumination was as out of date as the Act which made it necessary to have a man with a red flag walking in front of a mechanically-propelled vehicle. Efforts had been made to alter the standard long before the war; and this seemed a favourable opportunity for doing it.

The amendment was carried; and the minutes as amended were approved.

SOUTHPORT AND THE TERMS FOR TOLUOL.

The Southport Town Council, at their meeting last Tuesday, approved of resolutions of the Gas Committee that in future consumers who do not use sufficient gas per quarter to pay the interest and sinking fund on the meter, be charged a meter-rent, or the difference between the amount consumed and the amount of such interest and sinking fund; and that the Town Clerk be instructed to apply to the Board of Trade for authority to substitute a standard of calorific power for one of illuminating power. A letter was read from the Town Clerk of Stockton-on-Tees, in which, on behalf of his Corporation, he suggested that representation should be made to the Government with a view to payment or compensation in some other form being made to the various gas-works for toluol taken. The Gas Engineer (Mr. John Bond) presented a report on the matter; and the Town Clerk was instructed to reply in the terms of this report.

Mr. DUCKWORTH said they were already getting satisfactory terms for the toluol; and on patriotic grounds, he thought they ought not to ask for anything further.

Alderman TROUNSON added that the price they were getting for toluol was not satisfactory, in the sense that they were not getting value for the material produced; and were it not for the war, they would ask for an increase. But they were desirous of helping the Government; and the Southport Corporation were making, in this connection, a grant to the Government, through the offices of the Gas Engineer, possibly greater than any other corporation in the country.

SOUTH SUBURBAN COMPANY AND THE TRIBUNAL.

Military to Appeal.

Before the Lewisham Tribunal, on Monday of last week, application was made by the South Suburban Gas Company to retain the services of 91 employees and workmen, all engaged in processes other than those concerned in the production and distribution of gas.

The ACTING MILITARY REPRESENTATIVE (Mr. J. G. Prickett) asked that all the men passed for A and B1 should be ordered to join the Colours on March 31, and stated that this would give 13 out of 26 of the clerical staff, 6 of 8 slot collectors, and 38 out of 57 gas-fitters. For the men in lower categories, he was content that a short period of exemption should be given.

Mr. WILFRED WASTELL (the Secretary of the Company) stated, in reply to the Chairman (Mr. F. Mead), that the Company would be prepared to release men of A and B1 classes who were under the age of 31.

The MILITARY REPRESENTATIVE said he could not agree to any such proposal.

Mr. WASTELL then urged that if all the men for whom the Company were now applying were taken, they would be unable to fulfil their obligations to the consumers. The Company had come practically to the end of their resources; and, in the matter of fitters in particular, there was a considerable shortage of labour, though the business had grown since the outbreak of war. They were only kept going because so many of the old experienced staff were left. Of the pre-war clerical staff, 71 p ct. of those of military age were serving.

A majority of the Tribunal held that the men were all engaged in work of national importance, and granted three months' exemption in the case of A, B1, and C1 men, and six months' to those in the lower categories.

It was intimated that there would be an appeal on the part of the Military Representative.

NOTES FROM SCOTLAND.

Dumbarton Gas Management.—The "Glasgow Herald" last Friday stated that, "following on the decision of the Dumbarton Town Council to dismiss the Gas Manager, Bailie Lawrance has intimated his resignation from that body. He says he is convinced the dismissal is most unfair. Councillor Cormack has also publicly intimated that he is prepared to resign for the same reason. A meeting has been called in the town of those interested, to form a Committee of Inquiry regarding the action of the Council in dismissing the Gas Manager."

Meter Testing in Glasgow.—Reporting on the work of the Gas-Meter Testing Department of the Glasgow Corporation for the year 1916, Mr. S. B. Langlands (the Inspector) says that the total number of meters tested was 26,020, and the amount of fees collected £783. Of the meters, 24,794 were new and repaired ones, and 1226 were sent in by gas consumers for certification as to correctness. Of the new and repaired meters, 24,633 were correct and stamped, and 161 rejected—77 being fast in registration, 43 slow, 37 had ceased to register, and 4 had escapes at the index. With regard to meters sent in by consumers for certification, 804 were correct and stamped, and 422 rejected—255 being fast in registration, 154 slow, while 13 had ceased to register.

Perth Gas-Workers' Wages.—The Perth Gas Committee have received a letter from Mr. Mackenzie (the Secretary of the Gas Workers' Union) conveying the decision of the gas workers and meter-shop employees with reference to the Town Council's resolution as to the granting to them of a war bonus of 2s. per week. The men's decision is that they accept the 2s. granted by the Council "as an increase of wages, and not as a war bonus to be taken away at the pleasure of the Council." The Secretary desired to know if the Council agreed to this, and intimated that, failing the necessary affirmation, the advisability of making application for an Arbitrator to be appointed to deal with the original claim would be considered by the men. In view of the resolution having been come to by the Council, the Committee remitted the letter for the consideration of the Council.

Peterhead Gas Manager's Salary.—Practical appreciation of the services of Mr. William Ritchie, the Manager of the Peterhead Corporation Gas-Works, has been shown by the addition within a short time of £50 per annum to his salary. Eighteen months ago, the Town Council gave him an increase of £25; now they have unanimously voted him another one of similar amount.

Dumfermline Vertical Retorts.—Mr. John Gillespie is to report on the Dunfermline Gas-Works plant and machinery—particularly the vertical retorts. The points are whether such examination can reveal any fault which might account for the recent shortage, as well as the defective quality, of the gas supplied, and as to the present capital value of the vertical retorts and their probable life. The report has to give the productive capacity of the works at the present time, and whether they are capable of prospective development in the near future. A statement is desired of improvements or repairs which should be carried out on the plant and machinery; and as to whether there is any systematic method of measuring gas sent out under pressure. It is further asked whether it is desirable to separate the management of the productive department from that of the accountancy branch.

Gas-Works and Leaving Certificates.—At a sitting of the Dundee Munitions Tribunal, Mr. Alexander Yuill (the Gas Engineer and Manager) complained of Alexander Nicol, a fireman and engine-driver, having left his employment without permission. Nicol said he had to leave because the wages he received—32s. 5d. a week—were not sufficient to keep him in the circumstances in which he was placed. He had been employed at the gas-works for only ten days, and the rule was that he (being classed as a labourer) could leave at any time. He had made an offer to work until the end of the week. Mr. James Allison (who presided) held that there had been no offence committed against the rules of a controlled establishment. He had been strongly of opinion all along that if a workman gave proper notice, whatever it was, to his employer he was entitled to leave, and if he left without a leaving certificate, he left himself open to the situation that he had to go for six weeks without finding a job, unless he came across an employer ignorant enough to engage him. Nicol would have to go six weeks without getting work, and probably he would find it advisable to go back so as to get his certificate. Mr. Yuill had a similar complaint against John Locherty, a stoker and general labourer. The foreman stated that Locherty refused to change from what was known as winter to summer work. He left after his day's work was completed. Locherty stated that by the proposed change he would be sacrificing about 2s. a week. Mr. Allison said that the man did not require the complainant's permission to leave, although the Tribunal could not sympathize with his action. It was sufficient punishment that he would require to go idle for six weeks. In view of the decision in the previous case, the charge against Locherty was withdrawn.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb.* 19.

Coal tar pitch for export is quoted at about 24s. net per ton f.o.b. at makers' works. The difficulties of transport of coal are causing increased attention to be given to pitch for carbonization purposes. Other products are unchanged.

The export of sulphate of ammonia is still prohibited, so no export price is quoted. The home agricultural trade is very active at the new prices officially fixed on the 12th inst., which are briefly £16 net per ton for 24½ p.ct. quality, railway carriage paid, to farmers; while factors are to be charged 10s. less per ton. If taken *ex* works, the price remains as before—viz., to farmers, £15 10s. net for 24½ p.ct., bags free in all cases.

Tar Products in the Provinces.

Feb. 19.

There is no alteration in the market for tar products.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 9d. to 23s. 9d. Pitch, East Coast, 16s. to 17s. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3½d. to 3¾d. Heavy oils, in bulk, North, 3⅜d. Carbolic acid, 60 p.ct., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s., bags included. Anthracene, "A" quality, 3d. per unit; "B" quality, ¾d. to 1d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Feb.* 17.

There is no new feature to comment upon, so far as the export market is concerned, and actual values are unquotable. The price fixed for home agriculture has been altered from £15 10s. on rails at makers' works to £16 per ton delivered consumers' station for sales direct to farmers, with the same allowance as before—10s. per ton—to mixers and distributors.

Nitrate of Soda.

This market has again shown a considerable advance, and to-day's quotations are 22s. 9d. per cwt. for ordinary quality and 23s. per cwt. for refined, on spot.

Sulphate of Ammonia.

From another source, we learn that no prices are quoted for this article for export.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is still influenced by the lack of ready tonnage. There is also the doubt as to what effect may follow the State control of mines. Coals are generally plentiful; but forward business is not so readily entered into at present. In the steam coal trade, the current price appears to be about 30s. per ton f.o.b.; but the quotation is nominal. Second-class steams vary from 20s. to 24s. per ton, and steam smalls are rather steadier at from 17s. to 20s. 6d. There is a fair output; but it is scarcely full, in the circumstances—the higher freights not having had much effect yet in enlarging the available tonnage. In the gas coal trade, the demand is good for home needs, and also for France; but there seems a little more coal offering on the market, as was to be expected with the lengthening of the days. Best Durham gas coals are from 25s. to 27s. 6d. per ton, f.o.b., second-class gas qualities are 20s. to 21s. 6d., and "Wear Specials" are from 29s. to 32s. The latter kind are in good demand. There is little doing in the way of contracts for gas coals, though small lots are being sold—generally at near limitation prices. Freights on gas coal are higher, both to the South of England and to the French and Mediterranean ports. The demand for coke is full, and the production is slightly less. Gas coke is firm; the quotation being from 32s. to 33s. per ton f.o.b. in the River Tyne. The freight on coke is about 45s. per ton to the ports of Northern France.

Aberystwyth Gas Company.—The Directors of the Company, in presenting to the shareholders the accounts for the six months ended Dec. 31, express their satisfaction with the profit realized. "Singularly," they say, "this profit may be regarded as the result of adversity; for the working staff having been depleted of the last man that could be spared, there has been no possibility of executing works of maintenance—still less of extension. The result is observable in the greatly reduced charges against revenue. Happily, however, the plant is in such excellent order that the management are enabled to cope with the present onerous conditions with comparative ease." A sum of £344 has been refunded by the Inland Revenue Department, on account of profits below the pre-war scale during the year ended June 30, 1916. This sum nearly equals the amount which was paid on excess profits during the previous year. The Directors record their indebtedness to the Secretary (Mr. W. J. Fearnsides) for his successful conduct of this transaction. The balance of profit amounts to £1372, out of which the Board recommend payment of dividends at the rate per annum on the original shares of 12¾ p.ct., on the new shares of £8 18s. 6d. p.ct., and on the preference shares of £5 p.ct.—all less income-tax.

The Interruption of the Cleckheaton Gas Supply.

A paragraph appearing in last week's issue of the "JOURNAL" stated that on the previous Wednesday Cleckheaton had been without gas from noon to about 5 o'clock, owing to the freezing of the lute of the large gasholder. Mr. A. L. Jennings (the Engineer and Manager) has, however, since forwarded the following correct version of the occurrence, from which, he points out, it will be seen that it is more correct to say that the stoppage was directly caused by the freezing-up of the pipes and valves connecting the water-tank and boiler of a steam-roller which had been obtained to thaw the lute previous to the interruption of the gas supply, and by the breaking of a steam stop-valve on the engine: "On Wednesday, the town had the almost unique experience of being without gas from noon to about 5 o'clock, as the result of the severe frost. The trouble was with the large gas-holder at the works at Moorend; but the delay in getting the supply restored was really due to a combination of unfortunate circumstances. The holder is, of course, a telescopic structure, and the frost had bound the water-lute between the upper and lower parts, so that the movement of the upper portion was arrested; and as the frost had taken an unequal hold on different sides, there was the danger of a tilt, and of consequent serious damage. For this reason, the supply of gas to the town had necessarily to be stopped, as the depletion of the holder would have increased the danger. There had been 21° of frost during the night. The Council's steam road-roller was sent for, in order to get a steam-jet to work from it; but a good deal of delay was experienced, owing first to the fact that water could not be got into the boiler because the pipe leading from the supply-tank was frozen, and afterwards because of the breaking of the joint of the pipe with the boiler and of a valve-spindle. In the meantime, a steam-pipe had been laid from the gas-works boiler, and another steam road-roller had been got up from Liversedge; so that eventually three or four steam-jets were got to work, and the thawing of the lute of the holder was then quickly accomplished. At the wire-works in the town, in which gas is largely used for galvanizing and tempering, machinery had to stand in the meantime; and smaller works which depend upon gas power, &c., were also, of course, affected.

A Considerable Improvement at Scarborough.

It was stated by the Chairman (Mr. W. S. Rowntree), when moving the adoption of the report and accounts [*ante*, p. 263] at the annual meeting of the Scarborough Gas Company, that, inasmuch as they had been harder hit than any other similar undertaking in the country, they could congratulate themselves on the fact that, as the result of last year's working, the profits were only £1836 short of the amount required for the statutory dividends, which was a considerable improvement on the results of the previous twelve months, when the withdrawal from the reserve amounted to £6708. To achieve this result, after 2½ years of business under the most depressing conditions, and still have a balance of £13,560 remaining to the credit of the reserve account, was ample proof of the soundness of the business. Every effort had been made, by economy in working and improved results, to counterbalance increased expenses and decreased output. Coal cost slightly more than under the previous high-priced contracts; while oil had more than trebled in price. The special war items were now shown separately; and, although the expenditure had been heavy, he was sure they would heartily approve of the course the Board had taken in assisting the dependants of the men on war service, who now numbered 42, and also in compensating the remaining employees for the increased cost of living by means of a weekly war bonus which was granted last September. The sale of gas showed a small decrease of about 2 p.ct. Under the heading of residuals, which showed a net increase of £1100, chiefly due to the higher price obtained for coke, they would notice a new item for crude benzol. The benzol plant installed at the request of the Ministry of Munitions was only put to work at the beginning of December; but the Ministry had expressed their satisfaction with the result obtained. The extraction of benzol from the gas, however, rendered the use of flat-flame burners impracticable; and they were therefore being replaced by incandescent burners, free of charge. It was found, however, that this was scarcely sufficient; and the Board eventually decided to supply mantles for use with incandescent burners at the nominal price of 1d. each, in order to place them within the reach of even the poorest customer. He was confident that this policy would ensure the popularity of incandescent lighting in Scarborough for many years to come. They had been successful in obtaining an Order from the Board of Trade for the abolition of the obsolete illuminating power standard, in favour of a calorific or heating power standard. Alderman Hastings (a Director) spoke of the excellent work of Mr. A. Philip Allan (the Manager and Secretary), who had, he said, devoted the whole of his energy and ability to the service of the Company. He felt sure they had in Mr. Philip Allan a worthy successor of the late Mr. Alexander Allan, to whom the Company owed so much for its success.

Melton Mowbray Gas Company.—Owing to the advance in price of coal and a reduction in the consumption of gas during the past six months, the Directors of the Melton Mowbray Gas Company are not able to pay the usual interim dividend, but only 10s. per share, free of income-tax. There is no public lighting in the town; and the prospect of keeping up the consumption is said to be doubtful.

Thirsk Gas Company.—The annual report of the Thirsk Gas Company shows a profit of £823; and after charging interest on debenture stock and the interim dividend, there is a balance of £276. The Directors regret the greatly reduced profits, consequent on the increased cost of coal and other materials, and the diminished consumption of gas. They recommend that £100 be transferred from reserve, and that a dividend be declared, making, with the interim dividend, 7 p.ct. on the original capital, and 6½ p.ct. on the additional capital for the year. To meet the increased expenditure the Directors have under consideration the necessity of advancing the price of gas from the end of the present quarter.

Uxbridge Gas Company.

Presiding at the annual meeting of the Uxbridge Gas Company, Mr. H. E. Jones said that during the past year the work in every respect had been very good; but they had had a great deal of anxiety lately, as the poor people, being unable to obtain coal, had burned gas, and they had to meet the extra demand. He had to warn them then that, so uncertain and troublesome was the question of coal supply at the present time, that the larger companies especially were in great difficulty. Their Company had had to buy rail-borne coal. It was quite clear to the Directors that they could not hope to pay the same dividend next year; but they did not think it would diminish much. Practically every gas company was foreshadowing an increased price of gas. The accounts proved that Mr. Charles Hulme (the Engineer and Manager) had given the greatest possible attention to the undertaking. The returns showed 13,300 c.ft. of gas were produced per ton of coal carbonized. The report, which was adopted, stated that there was a net profit for the year of £11,860, which, added to the balance brought forward, together with £722 from the Eton Company's accounts on June 30, gave a total of £13,134. Deducting debenture and bankers' interest, left £10,333 available for dividend. The provision forthe dividend of 5 p.ct. on the preference stock enabled the Directors to recommend the payment of a dividend in accordance with the decrease in the price of gas as from the Midsummer quarter's meter-readings for the first half year at the rate of 5½ p.ct., and for the second half at the rate of 6 p.ct. per annum, making an average for the year of £5 18s. 9d., less income-tax, on the consolidated stock. This would absorb the sum of £9640, leaving a balance of £693 to carry forward. The Directors were glad to report that the Bill promoted last session for the acquisition of the Eton Gas Company received the Royal Assent on July 19; and in pursuance thereof the works, plant, and assets of that Company have been transferred.

Lighting of Dublin.—The estimate for the lighting of Dublin during the coming year is stated at £26,000, or £1500 less than last year. If the city were lighted on the same scale as before the war, the estimate would reach £37,000.

Gas-Works Slackers Heavily Fined.—Six employees of the Sheffield Gas Company were last Wednesday fined £4 and one £10 for neglect of duty by a breach of contract. It was stated the men left the works for two hours and three-quarters; and interfered with the production of gas to such an extent that about 323,000 cubic feet were lost to the Company.

Price of Gas at Newport (I.W.).—The Newport (Isle of Wight) District Council have been notified by the Gas Company that it has become necessary, owing to the continued high cost of coal and freight, and the increased price of materials and labour, to raise the cost of gas as from Christmas 4d. per 1000 c.ft, making the price for the ensuing year 4s. 4d.

Cambridge Gas Company.

Addressing the proprietors at the half-yearly meeting of the Cambridge University and Town Gaslight Company, Mr. E. H. Parker (the Chairman) said he thought the Board were entitled to congratulate the shareholders on the generally sound position disclosed. Coal, though less had been carbonized, had cost more by £1262; but there was a set-off, as coke had given an increased return of £1367. The revenue from the gas sold was not comparable with the figures of the corresponding half of 1915, as the price of gas had recently been reduced by 2d. per 1000 c.ft. The great difficulties with which the Engineer and Manager (Mr. J. W. Auchterlonie) had had to contend were the supply of labour, and the obtaining of the materials and their transport; but by his energy and tact these problems had so far been successfully dealt with. They must also congratulate him on the working results—12,272 c.ft. of gas per ton of coal carbonized, which was very good. The sales of gas showed a decrease of 1·6 p.ct., compared with the corresponding period of 1915. In the circumstances this result must be regarded as satisfactory, especially when it was considered that, in addition to other causes, daylight saving affected the first quarter materially. In common with a great many other gas companies, they had undertaken, at the request of the Minister of Munitions, to instal an oil-washing plant for the recovery of benzol from the gas. This had led to a change in the standard for testing the gas; a calorific test of 500 B.Th.U. having been substituted, after consultation with the Corporation, for the old 16-candle power test. In view of the large amount of gas now used for heating and power purposes, this change had often been advocated, and had already been made in many cases. The Company had now away on active service over 100 men. In answer to a question, the Chairman said all the time he had been connected with the Company, and long before, the Directors' fees had been paid free of income-tax; but in order to make the matter perfectly plain, they showed in the revenue account that the fees were free of income-tax. A dividend at the usual rates was declared.

Fatal Gas Accident at Cardiff.—A Cardiff widow, 81 years of age, was found dead in her room, with the tap of a gas-stove turned on but not lighted. She cooked her own food; and resented interference on the part of anyone. The Jury's verdict was that she died from asphyxiation accidentally sustained.

Sulphate of Ammonia for Corn Lands.—A correspondent of the "Yorkshire Post" last week quoted the experience of a farmer on the High Wolds, who said that after years of experiments, he would sooner buy sulphate of ammonia than have nitrate of soda given to him. The correspondent makes the suggestion that it would be a great advantage if all Farmers' Clubs would hold a special meeting to discuss the best means and time to apply sulphate of ammonia, and publish their findings in market rooms, &c. This would help a large number of farmers who are using sulphate for the first time.

The "Fire Queen"

The Latest "Main" Gas Fire.

It is designed to co-ordinate in size with *any* modern Interior Grate.

The fire backs and heights overall are graded to coincide with the dimensions of Standard Grates. Note the appearance when in use. So like a bright coal fire, and it will pass all the "tests" for Efficiency and Ventilation.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Cardiff Gas Company.

The annual meeting of the Cardiff Gaslight and Coke Company was presided over by Mr. Charles E. Dovey, F.C.A., who said the year's accounts had turned out better than anticipated. In addition to the restricted lighting regulations, they had to meet the greatly increased cost of coal and raw materials; so that, in spite of the most rigid economy in all departments, the Directors had been compelled to increase the price of gas by 3d. per 1000 c.ft. as from Dec. 25. They were keenly alive to the advantages of gas being offered to the public upon the very lowest terms, and would make a reduction at the earliest possible opportunity. They had applied to the Board of Trade for a standard of calorific value instead of illuminating power, which would be more in accordance with the present-day methods, and of considerable benefit to the majority of the gas consumers. He wished to say a word in appreciation of the practical and ready assistance rendered by women, who were now employed in many of the Company's departments and giving satisfaction. The report and accounts were unanimously adopted, and the usual dividends declared.

New Joint-Stock Company.—A Company has been registered, with a capital of £25,000 in £1 shares, to take over the business of incandescent gas-mantle ring manufacturers, carried on by W. A. Ward, J. Coles, and B. H. Dobbs, at Kent Street, Nottingham, as W. A. Ward & Co. It is a private Company; and the Articles of Association provide that each Director, except W. A. Ward, must also enter into a bond in the sum of £5000, with the condition that he will not acquire knowledge of the Company's secret processes until necessity arises, and that, having acquired such knowledge, he will not divulge same except as specified.

Croydon Gas Company.—When submitting at the meeting of proprietors next Friday the accounts for the half year ended Dec. 31, the Directors of the Croydon Gas Company will report that the sales of gas exceeded those of the corresponding period by 0·98 p.ct. The number of consumers increased in the half year by 431; and stoves on hire by 274 cookers and 934 fires, while 206 and 396 respectively have been sold to consumers, representing a total increase in gas-stoves of 1810. The Company have now 50,483 gas-stoves on hire, irrespective of the large number which have been purchased by consumers. A tar dehydration plant, ordered last year, is now approaching completion; and a debenzolizing plant is in course of erection. Both are designed for use in connection with the requirements of the Government. Over 300 employees have joined the forces. After providing for all fixed charges, there remains available for division a balance of £36,894; and the Directors recommend that dividends for the half year be declared at the following rates per cent. per annum: "A" stock, 14½; "B" and "C" stocks, 11½; "D" stock, 5; "E" stock, 10—all less income-tax. This will absorb £24,102, leaving a balance of £12,792 to be carried to the next account.

South Staffordshire Mond Gas Company.

The annual meeting of the Company was presided over by Mr. Robert Mond, who submitted the report of the Directors which was given on p. 223 of the "JOURNAL." He said the gross profit was £1529 less than the previous year, though the consumption of fuel and output of gas were practically the same. Over £1000 was lost through the breakdown of a coal-elevator, which necessitated a set of producers being shut-down. Leaving out of consideration the increased price and shortage of sulphuric acid, and loss due to fixed sale prices for sulphate, if during the year the fuel had been of the same quality as before the war, the revenue and consequently the profit, would have been over £8000 more than it was. Not only was the fuel bad, but it cost £6342 more than in 1915. Wages costs also increased. To meet the bigger demand, and at the same time safeguard the present supply to existing customers, another unit of plant was required. To set against increased charges of £13,718, they had been able to obtain an increased revenue of only £12,180. Indebtedness to the bankers increased from £20,291 to £26,071. As costs of all kinds were constantly increasing, and the banking account was largely overdrawn, the Directors recommended that no dividend be declared on either the preference or ordinary shares. Sir Gilbert Claughton remarked that there were many small industries, and two or three important ones, that would have come to an absolute standstill had it not been for the supply of Mond gas; and although the present position of the Company was not a rosy one, they had the satisfaction of knowing that they had helped their neighbours in a very difficult time. The report was adopted; and at a subsequent meeting the shareholders approved the promotion of a Bill to confer further powers on the Company.

Bournemouth Gas and Water Company.—In presenting the accounts of the Company for the half year ended Dec. 31, the Directors report that the revenue receipts under every head show a substantial increase when compared with the corresponding half of 1915; the sales of gas being nearly 7 p.ct. more. The supplies of both commodities have been satisfactorily maintained, notwithstanding the many difficulties that have been experienced in connection with the supply of both materials and labour. All the employees have rendered loyal service to the Company. The revenue expenditure reflects in the accounts the increased cost of coal and other materials, and the advances which the Directors have granted to the staff and workmen. Further increased costs will be incurred this half year; and the Directors deem it necessary to increase the price of gas by another 2d. from Lady-day next, to 3s., 3s. 2d., and 3s. 10d. in the Bournemouth, Poole, and Christchurch districts respectively. The Directors have made application to the Board of Trade for an Order under the Gas (Standard of Calorific Power) Act, 1916, for the substitution of a calorific standard for the present basis of illuminating power. After writing-off £3500 for works superseded, the Board recommend the payment of the statutory dividends, which will leave £24,435 to be carried forward.

We were the pioneers of **EFFICIENCY** in Gas Radiants.

Our **"THERMO-X"**

RADIANT has all along held, and still holds, the premier position for

= EFFICIENCY =

And that efficiency is accompanied by a degree of

STRENGTH

that we have not found equalled in any other radiant

JOHN WRIGHT & CO.,
Essex Works, BIRMINGHAM

The Calorific Standard Act a Safeguard and Asset.

Two articles on the Gas (Standard of Calorific Power) Act, 1916, contributed by a Technical Correspondent, have appeared in the "Municipal Journal;" the concluding sentences being in these terms: "During the coal strike of 1912, the authorities were compelled, owing to the limited supply of coal, to give undertakings a free hand in the matter of gas manufacture, in order to obtain the maximum amount of gas from the coal. The result was that in one large district alone the nominal illuminating power of the gas was reduced sufficiently to enable the gas undertakings to save 65,000 tons of coal in two months; and the public never noticed the difference, because the heating power was practically unaffected. Such a saving was only rendered possible by the suspension of the old method of testing gas for illuminating power. This suspension was but temporary; but the lesson was not lost upon the Government. Nor should it be lost upon the public, all the enlightened members of whom must realize that the recent Act is not only a national safeguard in time of war, but a financial asset in time of peace.

Price of Gas at Omagh.—The Omagh Urban District Council have agreed to support the movement initiated by Lisburn for legislative action to enable local authorities to increase the price of gas to meet the heavy outlay on coal and other materials.

British Coalite Company.—The British Coalite Company, Ltd., state that, in accordance with a resolution of the second mortgage debenture stockholders, an additional £25,000 of stock has been registered, making the total amount authorized £100,000. A supplemental trust-deed has also been registered, under which this £100,000 of stock becomes first mortgage debenture stock of the Company.

Enemy Companies to be Wound Up.—Orders have been made by the Board of Trade under the Trading with the Enemy Amendment Act, 1916, requiring the following businesses to be wound up: Coal Distillation Company, Middlesbrough, manufacturers of coke-ovens and bye-products plants. Brimsdown Lamp Works, Ltd., Kingsway House, W.C., manufacturers and dealers in lamps and fittings.

Wellingborough Gas Company.—In their report to the shareholders on the operations of the past half year, the Directors of the Wellingborough Gaslight Company, Ltd., state that, notwithstanding the lighting restrictions, the decrease in the sale of gas amounted to only 4½ p.ct., when compared with the corresponding period of 1915. This satisfactory result is due to its increased use for power, heating, and cooking purposes, and to the presence of troops in the town for the latter part of the half year. The Company's application for the substitution of a calorific standard for the standard of illuminating power has been granted by the Board of Trade. The Board recommend that dividends for the half year of 6⅝ p.ct. on the original shares and 5⅛ p.ct. on the additional shares, less income-tax, be declared.

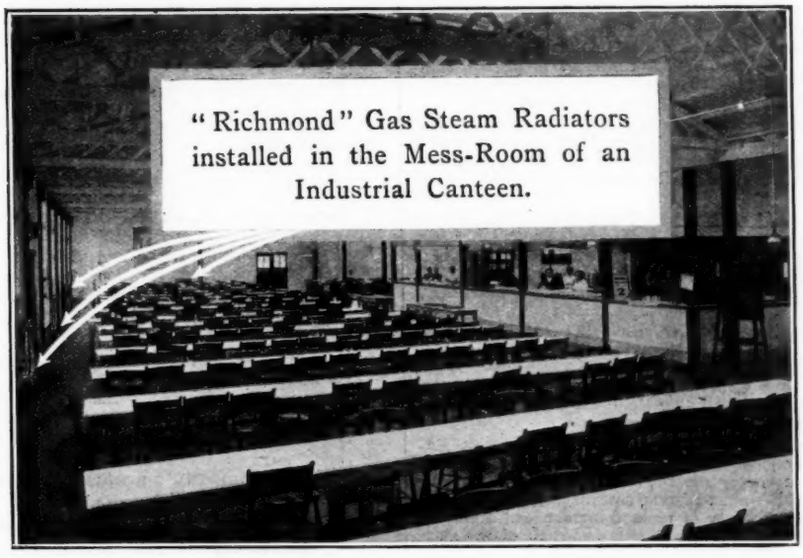
Wandsworth, Wimbledon, and Epsom District Gas Company.

The report to be submitted to the proprietors next Tuesday, which is signed by the Chairman (Mr. H. E. Jones) states that the revenue account for the half year ended Dec. 31 shows a profit of £26,987. After providing for the interest on debenture bonds and stock, and transferring an amount of £5200 from the special purposes fund in connection with the stranding of the s.s. *Mitcham*, there remains to the credit of the profit and loss (net revenue) account an amount of £32,097 available for payment of dividends. The Directors therefore recommend that dividends be declared at the statutory rates as follows: On the Wandsworth "A" stock, 8; on the Wandsworth "B" stock, 6½; on the Wandsworth "C" stock, £5 12s.; on the Wimbledon stock, 5⅞; on the Epsom stock, 6⅛; and on the new ordinary stock, £5 12s. p.ct. per annum. The sale of gas shows an increase of 3·9 p ct. over the corresponding period of 1915. The increase in the number of consumers is 575, and in the stoves at rental 2113. Turning to the accounts, it is seen the receipts on revenue account amounted to £257,588, and the expenditure to £230,600. The quantity of gas made was 1,371,670,000 c.ft., and the total quantity accounted for 1,273,713,000 c.ft. The prices at which gas was sold for private purposes were 2s., 2s. 7d., and 3s. per 1000 c.ft. The quantity of coal carbonized during the half year was 94,951 tons, and of oil used 300,377 gallons. The estimated coke made was 59,345 tons, breeze 14,641 tons, tar 977,452 gallons, and sulphate of ammonia 904 tons.

Droitwich Gas Undertaking.—As stated elsewhere, the Droitwich Gas Committee have taken up £500 of the new War Loan (besides £250 of the loan of 1915). A proposal was made to invest £1000 in the loan; but owing to some arrangement existing with the borough fund, the Committee were unable to do so. The Engineer and Manager (Mr. Reginald Thomas) points out that the Committee have not increased the price of gas during the war; and it is now only 2s. 8d. per 1000 c.ft. The workmen have also been granted a war bonus of 3s. per week.

Gas and Modern Business.—Before the Huddersfield St. Andrew's Society, last Thursday, Mr. H. A. Bennie Grey lectured on "Gas in Relation to Modern Business," and said that the conversion of old and the initiation of new industrial processes, which had been going on in this country to a much greater extent than was generally known, was made possible by the ready adaptability of gas. As an example, he mentioned a firm of musical instrument makers, who, finding a reduced demand with the advent of the war, installed gas-furnaces and were now producing important army supplies. Gas most perfectly met the requirements of clean, concentrated, easily controlled, and intense heat for motor and transport industries. The lecturer went on to show the advantages of gas as a heater, and its importance in machine shops where furnaces have to be introduced in close proximity to machines, and where cleanliness is of primary importance.

Gas Heating for Canteens, Etc.



Specially suitable for Canteen and Workshop heating, Richmond's Gas Steam Radiators are being very extensively adopted in all kinds of Factories. Our co-operation is offered in approaching local Firms upon the subject of heating apparatus.

THE RICHMOND GAS STOVE & METER CO., Ltd.,
WARRINGTON AND LONDON.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Feb. 14.]

Nos. 1778-2068.

APPLEBY, E. G.—"Gas-producers." No. 2050.
BENTLEY, G. H.—See Appleby. No. 2050.
COCKSEDGE, H. E.—"Manufacture of ammonium nitrate." No. 1888.
COLONA, G. C.—"Generation of gases for light, heat, power, &c." No. 1779.
FREETH, F. H.—See Cocksedge. No. 1888.
HELPS, G.—"Utilization and combustion of fuel." No. 1792.
MAITLAND, D.—See Colona. No. 1779.
PEASE, E. L.—"Heat-interchanging apparatus." No. 1955.
WAITE, T. C.—"Gas-fittings." No. 1846.

Peterborough Gas Company.—Alderman D. H. Redhead presided at the half-yearly meeting of the Company, when the Directors' recommendation was adopted for the payment of 5 p.ct. on the new preference "A" shares and of 8 p.ct. on the consolidated ordinary stock, less income-tax. It was reported that the total revenue for the half year had been £21,322, or slightly over £1000 less than in the previous year. Of this, £14,253 had been derived from the sale of gas, including £7615 from prepayment meters. During the six months 9673 tons of coal were carbonized.

Tynemouth Gas Company.—The Directors report that the revenue for the past year amounted to £96,540, and the expenditure to £86,147—leaving a balance of profit of £10,393. With the undivided profit brought forward, there is an available balance of £15,607, out of which the Directors propose to pay dividends at the rate per annum, less income-tax, of 5 p.ct. on the consolidated and new ordinary stocks, and 4 p.ct. on the preference stock, which will leave a sum of £5628 to be carried forward. The number of ordinary and prepayment meters in use at Dec. 31 was 22,980; being an increase of 169. In consequence of the greatly increased price of coal and material, the Directors deem it necessary to announce an advance of 2d. per 1000 c.ft. in the price of gas to ordinary consumers, from the next reading of the meters.

A proposal has been made at Cashel (co. Tipperary) to increase the price of gas from 5s. 10d. to 7s. per 1000 c.ft.

The Local Government Board have sanctioned the borrowing of £1200 for the installation of a benzol recovery plant at the Sowerby Bridge Gas-Works.

The Directors of the Bland Light Syndicate, Ltd., have declared an interim dividend on the ordinary shares at the rate of 6 p.ct. per annum for the six months ended Oct. 31 last.

Owing to a short-circuit on the switchboard at the Wakefield Corporation electricity works recently, the city had no electric light from 5.15 in the evening to 3.30 next morning. Fortunately for shopkeepers, it was their half-holiday.

The Newton-in-Makerfield Council have decided to apply to the Local Government Board for sanction to borrow money to complete the new gas-works. The Clerk stated that the estimated expenditure of £16,000 would be considerably exceeded.

Mr. J. Drummond Paton, of 25, Market Street, Manchester, has been appointed Agent for the Coppée Company (Great Britain), Ltd., in the Lancashire and North-West district, in connection with their business as bye-product coke-oven and coal-washery builders.

John Dowse, 84 years of age, has died in Boston through accidentally inhaling gas. He was found unconscious in his bedroom with the gas-tap turned full on. The tap was near the window, and it is thought he unknowingly moved it in going to draw the blind.

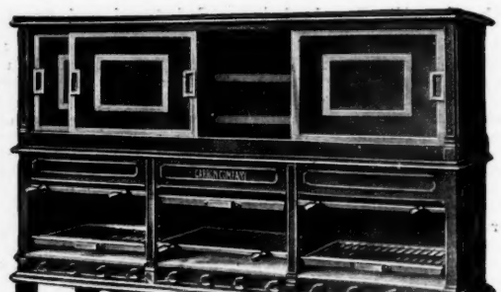
When the Ripon Gas Manager appealed to the local Tribunal last Friday week for the renewal of a fitter's exemption, he said repeated attempts had been made to obtain a substitute, but without success. Conditional exemption was granted, on the man undertaking to join the V.T.C.

At the last meeting of the Stretford Urban District Council, a proposal from the Gas Company for the automatic control of street lamps in their lighting area was submitted. The Highways Committee gave consideration to the matter; and it was not deemed advisable to take action at present. They recommended, however, that, if opportunity arises, a test should be made.

The Bridlington Gas Company last week advanced the war bonus to their employees from 3s. 6d. to 6s. per week. The increase was not applied for; and the surprise grant has been much appreciated by the workers. The Ossett Town Council have approved a recommendation by the Gas Committee that an additional war bonus of 2s. per week be granted to certain sections of the employees.

The Harrogate Corporation have authorized their Electrical Engineer to prepare specifications and advertise for tenders for the erection of a steam plant, designed by himself, which embodies in one self-contained unit of reasonable size and capital cost the features of smokeless combustion with the recovery of tar and ammoniacal liquor as bye-products. After submission of the designs on behalf of the Corporation, he has been granted by the Ministry of Munitions a certificate for the construction of the plant.

Since the outbreak of the war, applications have been received at the Department of Commercial Intelligence, No. 73, Basinghall Street, E.C., from firms in the United Kingdom and abroad who wish to get into communication with British manufacturers or producers of various classes of goods which have previously been obtained from Germany and Austria-Hungary. Applications have been recorded during the past week for the names of manufacturers or producers of (among other articles) knitted fabric for gas-mantles. British manufacturers or producers now in a position to supply are invited to make application for the name of the inquirer.



By Appointment.

Cater for your Workers with the minimum of trouble and expense

by using

CARRON Gas COOKING APPARATUS

These Appliances are made in such a wide variety of styles and sizes as to meet any requirement or contingency. You have the testimony of the catering world that no better Appliances can be had—anywhere—at any price, besides the reputation of the Manufacturers, which extends back to the reign of George II.

Carron Cooking Appliances are adopted by the leading HOSPITALS, ASYLUMS, INSTITUTIONS, STEAMSHIP LINES, etc., by MUNITION and other MANUFACTURERS, and by the MILITARY AUTHORITIES at Home and on the Continent.

Existing Plant altered or augmented, or New Plant installed on the shortest notice.

Illustration shows combined Gas Griller, Toaster, and Hot Closet suitable for Cooking for a large number of workers. Mounted on cast-iron stand with grid-shelf between legs. Strongly constructed in cast-iron, and most suitable for hard continuous use.

Each grilling compartment is heated by four independently-controlled Bunsen burners, and is complete with grill, tin, and tinned grid, etc. Each compartment will toast perfectly about 20 rounds under two minutes, the grilling power being in proportion.

The Company's profusely illustrated and descriptive catalogue should be in the hands of all Munition Manufacturers interested. Write for a free copy to-day.

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STOCK MARKET REPORT.

THE Stock Exchange has had a strangely chequered week. In the early portion, under the influence of the excitement and enthusiasm which intensified as the hour for the closing of the War Loan subscription drew near, markets were in a state of agitation. There was what may be described as a patriotic pressure to sell anything that was saleable, and pour the proceeds into the Bank of England Loan account. As a natural result, prices in the selling quarters underwent a shrinkage. Another feature which distracted attention from usual lines was the appearance on the scene of War Loan Sweepstakes, which caught on at once from their birth, and achieved remarkable popularity. The markets had already been lightened to some extent from the weight of sales, and the rest of the week was quite cheerful. Setting aside the dulness of the first few days of the week already referred to, gilt-edged descriptions were in good case. In Home Government issues, prices generally were much firmer; but the 4½ per cent. War Loan, being now *ex* conversion rights, was marked down accordingly. Home Rails were in good demand, and strengthened their position materially.

The Foreign Market was quiet and cautious; the German submarine challenge to all nations, with its attendant possibilities of rupture to international relations, having a disturbing influence. Americans were not very good; but Argentines had quite a recovery, and South Africans were fair. The Miscellaneous Market was full of bright spots of all descriptions.

Business in the Gas Market was very restricted in volume; only some six or eight undertakings being dealt in at all. As far as the figures of recorded bargains afford any indication, there was no rush to sell for War Loan purposes; the prices marked being much about the same as those of the week before. Most of the larger companies have held their annual or semi-annual meetings with satisfactory results; the proprietors everywhere recognizing how severely war conditions weigh upon the gas industry. In the Money Market, there was a gradual hardening up till Friday, when easier conditions supervened.

Bargains done for cash during the week were as follows: On Monday, Commercial 3½ per cent. 68, Gas Light ordinary 71¾, 72, 72½, ditto maximum 56¾, Imperial Continental 72, ditto debenture 60, Primitiva, 40s., 40s. 4½d. On Tuesday, Gas Light ordinary 71½, 71⅝, ditto maximum 55½, 56¼, 56¾, ditto debenture 54½, 54⅜, 54⅞, 55, Maidstone 5 per cent. 91½, 92, Primitiva preference 58s. 9d., ditto debenture 79⅛, 79½, South Metropolitan 77, 77½, 77⅜, 78½, ditto debenture 54½. On Wednesday, Commercial 4 per cent. 73½, 74, ditto 3½ per cent. 68, 68⅛, Gas Light ordinary 71, 71¼, 71½, ditto preference 69½, 69⅝, ditto debenture 54½, 54⅝, Imperial Continental 71¼, 71¾, 72, Primitiva 40s., ditto preference 57s. 6d., 58s. 9d., South Metropolitan 77½, ditto debenture 54½, 54½. On Thursday, European 9, 9⅛, 9⅜, Gas Light ordinary 71½, 71½, 71¾, ditto preference 69¼, Imperial Continental 71½, Primitiva 40s. On Friday, Bournemouth "B" 11, 11½, European 9 5/16, 9½, Gas Light ordinary 71½, 71½, 71⅝. 71¾, Primitiva preference 61s. 3d., South Metropolitan 77. On Saturday, European, 9⅜, Gas Light maximum 56½, 56¼, South Metropolitan 77½, 77⅝, 77¾.

The Bank rate is 5½ p.ct., as fixed on the 18th of January.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend and Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	65—70	..
1,551,868	,,	April 8	2½	5⅛%	Alliance & Dublin Ord.	59—64	62—64	..
574,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	58—63	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6⅜	4⅜—5⅛	..
50,000	10	Feb. 26	16	15/-		29—30	25—27	..
323,110	10	,,	7	7/-	Bournemouth Gas and Water { 10 p.c. B 7 p.c.	15—15½	11—11½	11—11⅛
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	9½—10	..
159,740	—	—	—	4%	4 p.c. Deb.	..	71—73	..
992,045	Stk.	Feb. 26	14	55/-	Brentford A Consolid.	261—266	85—87	..
734,920	,,	,,	11	53/9	Do. B New	204—209	82—84	..
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	85—90	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—93	67—69	..
217,380	,,	Feb. 26	11	10⅞%	Brighton & Hove Orig.	208—213	160—165	..
244,200	,,	,,	8	7⅞%	Do. A Ord. Stk.	154 - 159	115—120	..
530 000	20	Mar. 26	12½	22/6	British	44—45	34—35	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	66—68	..
245.771	,,	,,	4	4%	Buenos Ayres 4 p.c. Deb.	85—87	57—60	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	1½—1¾	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	82—83	..
1,513,280	,,	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	73—75	73½—74
560 000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	68—70	68—68½
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	36—38	..
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	58—60	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	175—185	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5⅞%	Derby Con. Stk.	123—125	100—105	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,092,180	10	July 29	10	7/6	European, Ltd.	17½—18	9—10	9—9½
16,313,430	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord.	98—102	71—73	71—72½
2,600,000	,,	,,	3½	3½%	3½ p.c. max.	76—79	55—58	55½—56½
4,062,235	,,	,,	4	4%	4 p.c. Con. Pref.	96—99	69—71	69½—69½
4,674 850	,,	June 11	3	3%	3 p.c. Con. Deb.	72½—74½	54—56	54½—55
130,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
2 8,740	,,	Mar. 12	5	4½%	Hastings & St. L. 3½ p.c.	87—89	78—83	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16½	8—9	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	125—135	..
131,000	Stk.	Mar. 12	7½	7½%	Ilford A and C.	151—154	105—110	..
65,780	,,	,,	6⅜	5⅞%	Do. B	115—118	82—87	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	71—74	..
4,910,000	,,	May 14	9	4½%	Imperial Continental	150—160	70—75	71½—72
1,235,000	,,	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	58—61*	60
235,242	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92	..
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A B	211—213 146—148	84—86	..
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	72—74*	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅜	3⅞—4⅛	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	89—93	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8—8½	..
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	98½—99½	73½—74½	..
529,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	73—75	..
55,940	10	Feb. 26	7/14/0	7/8⅛	North Middlesex 7 p.c.	14—15	10½—11½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅛—7⅜	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	95—100	..
100,000	50	,,	12	11%	Do. C	118—121	88—93	..
52,000	50	,,	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	1⅞—2½	40/—40/4½
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4½—5	55/—65/-	57 6—61/3
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	78—80	79½—79½
—	—	—	—	4%	Do. ,, ,, 1911	..	..	..
316,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	61—67	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	8—8½	..
125,000	50	July 1	5	5%	6 p.c. Deb.	47—49	42—44	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	188—192	..
203,984	,,	,,	10	10%	Do. B	223—224	188—192	..
523 500	,,	,,	10	10%	Do. C	220—222	188—190	..
90,000	10	May 28	9	6/-	South African	10½—11½	..	..
6,609,895	Stk.	Feb. 10	5/4/0	46/8†	South Met. 4 p.c. Ord.	111—113	77—79	77—78½
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	54—56	54½—54½
224,820	,,	Feb. 26	8½	8%	South Shields Con. Stk.	137—150	144—146	..
952,795	,,	,,	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	..
67,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	79—81	..
135 000	,,	—	—	48/4	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	88—90	..
647,740	,,	May 14	5	5%	Southampton Ord.	99—102	77—79	..
120,000	,,	Feb. 12	7½	7½%	Tottenham District { A 5 p.c. B 3½ p.c.	135—138	100—105	..
782,275	,,	,,	6	58⅜%		115—117	70—75	..
181.255	,,	June 26	4	4%	4 p.c. Deb.	87—89	65—67	..
182 380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	91—92	..
					Wandsworth, Wimbledon, and Epsom—			..
30,000	,,	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	117—122	
256 636	,,	,,	6¼	63/9	Do. B 3½ p.c.	129—134	101—103	..
108,075	,,	,,	5/17/3	55/1½	Do. C 3½ p.c.	110—115	88—93	..
352,000	,,	,,	6¼	57/6	Wimbledon 5 p.c.	117—122	90—95	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	121—126	98—103	..
88,416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	51—54	..

* Ex. div. † Next dividend will be at this rate.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ASSISTANT ENGINEER. Applications by Feb. 27 to No. 6282.
DRAUGHTSMAN. No. 6275.
CARBONIZING FOREMAN. No. 6274.
ELECTRICIAN (Charge of Installation). No. 6274.
FOREMAN (METER WORKS). No. 6283.
WATER-GAS OPERATOR. West Bromwich Gas-Works.
CLERK. Sheerness Gas Company.
STOKERS. Fleetwood Gas-Works.

Appointments, &c., Wanted.

GAS ENGINEER. No. 6279.
MANAGER OR MANAGER AND SECRETARY. No. 6280.
WORKING MANAGER OR FOREMAN. No. 6278.
REPRESENTATIVE. No. 6281.

Plant, &c. (Second Hand), for Sale.

EXHAUSTERS, HYDRAULIC MAIN, &c. Broadstairs Gas Company.

Meetings.

HARROW GAS COMPANY, 5, Great Winchester Street, E.C., March 5. 2.30 o'clock.
NORTH MIDDLESEX GAS COMPANY. 5, Great Winchester Street, E.C., March 5. 3.30 o'clock.
SOUTHGATE GAS COMPANY. 5, Great Winchester Street, E.C., March 1. 3.30 o'clock.

Capital Issues.

CREDITON GAS COMPANY. By Auction, March 7.
TITCHFIELD GAS COMPANY. By Auction, March 7.
UNITED DISTRICT GAS COMPANY. By Auction, March 7.
WADHURST GAS COMPANY. By Auction, March 7.

TENDERS FOR

Fire-Clay Goods.

RHONDDA URBAN DISTRICT COUNCIL. Tenders by Feb, 28.

General Stores (Lime, Drysaltery, Oils, Ironmongery, &c.),

RHONDDA URBAN DISTRICT COUNCIL. Tenders by Feb. 28.

Meters.

RHONDDA URBAN DISTRICT COUNCIL. Tenders by Feb. 28.

Pipes.

RHONDDA URBAN DISTRICT COUNCIL. Tenders by Feb. 28.

Tar and Liquor.

HAWORTH URBAN DISTRICT COUNCIL. Tenders by Feb. 24.
LIMERICK GAS COMMITTEE. Tenders by Feb. 26.
MANCHESTER GAS COMMITTEE. Tenders by March 29.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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See Illustrated Advertisement, Feb. 13, p. 278.

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TO comply with Regulation 8 (*b*) of the above Act, advertisements from firms whose business consists wholly or mainly in Engineering, Shipbuilding, or the production of Munitions of War, or of substances required for the production thereof, must include the words "No person resident more than ten miles away or already engaged on Government work will be engaged."

ADVERTISERS SHOULD ALSO MAKE NOTE that the taking of steps to obtain the services of an alien for work other than munitions work in the United Kingdom is prohibited except with the permission of the Board of Trade.

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